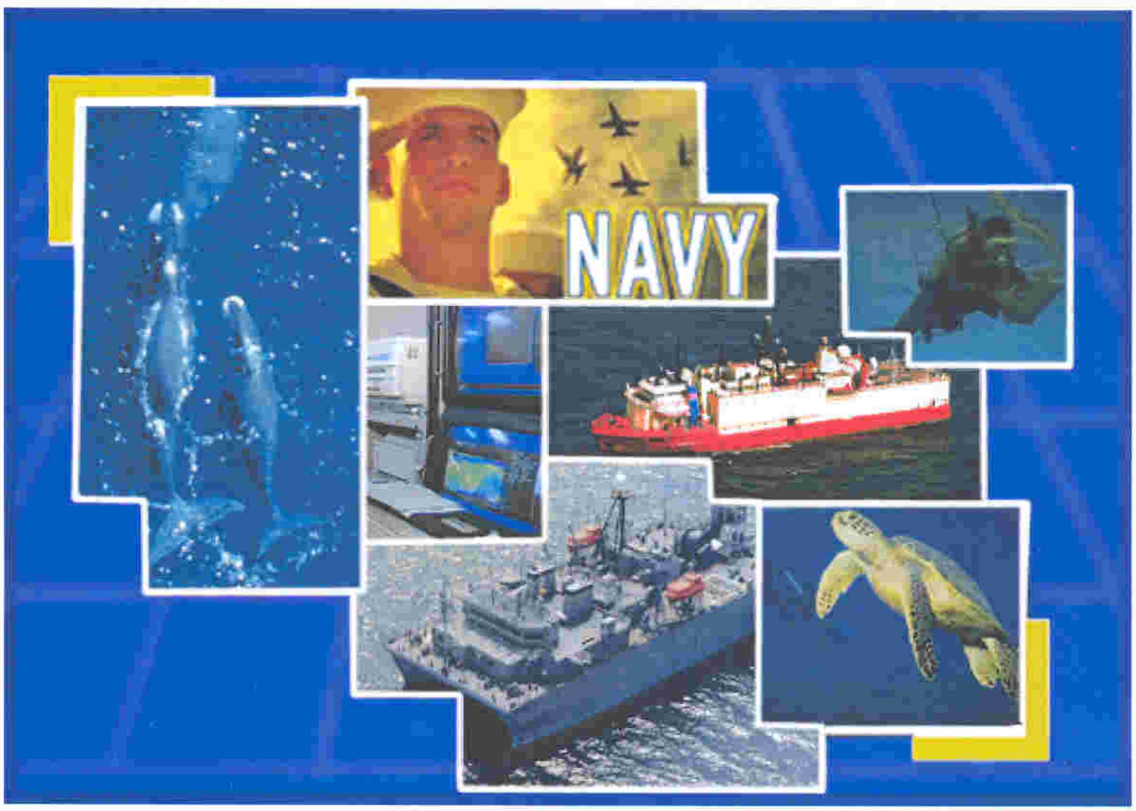
Annual Report No. 3:

Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* *and* USNS IMPECCABLE (T-AGOS 23)

Under the National Marine Fisheries Service Letters of Authorization Of 13 August 2004



Department of the Navy
Chief of Naval Operations
May 2005

DEPARTMENT OF THE NAVY

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27 May 05

From: Program Executive Officer, Littoral and Mine Warfare (PMS 485)

To: Office of Protected Resources
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Silver Spring, Maryland 20910

Subj: ANNUAL REPORT NO. 3 FOR THE OPERATION OF THE SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE (SURTASS LFA) SONAR ONBOARD THE R/V *CORY CHOUEST* AND USNS IMPECCABLE (T-AGOS 23)

Ref: (a) Final Rule: Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar (67 Federal Register 46712-46789)
(b) Letter of Authorization Governing the Take of Marine Mammals Incidental to the U.S. Navy's Operation of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar on the R/V *Cory Chouest*, Office of Protected Resources, National Marine Fisheries Service, August 13, 2004
(c) Letter of Authorization Governing the Take of Marine Mammals Incidental to the U.S. Navy's Operation of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar on the USNS IMPECCABLE (T-AGOS 23), Office of Protected Resources, National Marine Fisheries Service, August 13, 2004

Encl: (1) Annual Report No. 3: Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) Under the National Marine Fisheries Service Letters of Authorization of 13 August 2004

Subj: ANNUAL REPORT NO. 3 FOR THE OPERATION OF THE SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE (SURTASS LFA) SONAR ONBOARD THE R/V *CORY CHOUEST* AND USNS IMPECCABLE (T-AGOS 23)

1. The third Annual Report for the operation of SURTASS LFA sonar onboard the R/V *Cory Chouest* and the USNS IMPECCABLE (enclosure (1)) is submitted in accordance with references (a), (b) and (c).

2. The point of contact for this effort is the PMS 485 Chief Engineer, Joe Johnson. He can be reached at (858) 537-8967.

J. S. JOHNSON
By direction

Annual Report No. 3:

Operation of the Surveillance Towed Array Sensor System

Low Frequency Active (SURTASS LFA) Sonar

Onboard the R/V *Cory Chouest*
and
USNS IMPECCABLE (T-AGOS 23)

Under the National Marine Fisheries Service

Letters of Authorization

of 13 August 2004

May 2005

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1.0 INTRODUCTION

Under the SURTASS LFA sonar Final Rule 50 CFR 216.186(b) and Condition 8(b) of the annual SURTASS LFA sonar Letters of Authorization (LOAs) for the USNS IMPECCABLE (T-AGOS 23) and Research Vessel (R/V) *Cory Chouest*, this report provides an unclassified summary of the classified quarterly reports of SURTASS LFA operations for the period 16 February 2004 through the quarter ending 15 February 2005.

1.1 Purpose of this Report

As a requirement of the Regulations for the Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar, 50 CFR 216 Subpart Q (67 *Federal Register* [FR] 46785-89), this annual report for operation of SURTASS LFA sonar onboard the USNS IMPECCABLE (T-AGOS 23) and R/V *Cory Chouest* has been prepared in accordance with the requirements of the Letters of Authorization (LOAs) issued by the United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS). The primary purpose of this annual report is to provide NMFS with unclassified SURTASS LFA sonar operations information to assist them in their evaluation of future Navy LOA applications.

Because there is a potential that operation of the SURTASS LFA sonar could result in incidental harassment of marine mammals, it was decided in consultation with NMFS that the employment of SURTASS LFA would require authorization by rule making for a five-year period with annual renewals through the issuance of Letters of Authorization for each SURTASS LFA vessels for areas of intended operation. On 1 April 1998, NMFS agreed to be a cooperating agency under the National Environmental Policy Act (NEPA) for the SURTASS LFA environmental impact statement (EIS). Cooperating agencies have jurisdiction by law or special expertise with respect to certain environmental impacts from a proposed action by another agency—specifically, NMFS is the federal regulator for the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA).

1.2 SURTASS LFA Sonar Description

SURTASS LFA is a long-range, all-weather, sonar system that operates in the low frequency (LF) band (100-330 Hz). There are presently two SURTASS LFA sonar systems, one each onboard the USNS IMPECCABLE (T-AGOS 23) and R/V *Cory Chouest*, both operating in the northwestern Pacific Ocean. These systems have both passive and active components.

The active system component, LFA, is an augmentation to the passive detection system, and is planned for use when passive system performance proves inadequate. LFA is a set of acoustic transmitting source elements suspended by cable from underneath a ship. These elements, called projectors, are devices that produce the active sound pulse, or ping. The projectors transform electrical energy to mechanical energy that set up vibrations or pressure disturbances within the water to produce a ping. This is analogous to a stereo speaker or the earpiece in a telephone handset.

The characteristics and operating features of LFA are:

- The source is a vertical line array (VLA) of up to 18 source projectors suspended below the vessel. LFA's transmitted sonar beam is omnidirectional (i.e., a full 360 degrees) in the horizontal (nominal depth of the LFA array center is 122 m [400 ft]), with a narrow vertical beamwidth that can be steered above or below the horizontal.
- The source frequency is between 100 and 330 Hertz (Hz) (the LFA system's physical design does not allow for transmissions below 100 Hz). A variety of signal types can be used, including continuous wave (CW) and frequency-modulated (FM) signals. Signal bandwidth is approximately 30 Hz.
- The source level (SL) of an individual source projector is approximately 215 decibel (dB). The sound field of the LFA array can never be higher than the SL of an individual projector.
- The typical LFA transmitted sonar signal is not a constant tone, but a transmission of various waveforms that vary in frequency and duration. A complete sequence of transmissions is referred to as a ping and lasts from 6 to 100 seconds, although the duration of each continuous frequency transmission is never longer than 10 seconds.
- Duty cycles (ratio of sound "on" time to total time) are less than 20 percent—20 percent is the maximum physical limit of the LFA system. Typical duty cycles are approximately 7.5 to10 percent.
- The time between pings is typically from 6 to 15 minutes.

The passive, or listening, part of the system is SURTASS, which detects returning echoes from submerged objects, such as submarines, through the use of hydrophones. These devices transform mechanical energy (received acoustic sound wave) to an electrical signal that can be analyzed by the signal processing system of the sonar. They are analogous to a microphone or the mouthpiece of a telephone handset. The SURTASS hydrophones are mounted on a receive array that is towed behind the vessel. The SURTASS LFA ship must maintain a minimum speed of approximately 5.6 kilometer per hour (kph)(3 knots) through the water in order to tow the hydrophone array in the horizontal plane. The return signals or echoes, which are usually below background or ambient noise level, are then processed and evaluated to identify and classify potential underwater targets.

1.3 The Critical Need for SURTASS LFA

The original stated purpose for the SURTASS LFA sonar from the Final SURTASS LFA Sonar Overseas Environmental Impact Statement/Environmental Impact Statement (OEIS/EIS) was:

> "The purpose of the proposed action is to meet U.S. need for improved capability to detect quieter and harder-to-find foreign submarines at long range. This capability would provide U.S. forces with adequate time to react to, and defend against, potential submarine threats while remaining a safe distance beyond a submarine's effective weapons range." (DON, 2001)

This statement remains valid, and indeed may be even more compelling now than when it was presented in the Final OEIS/EIS in January 2001 (DON, 2001). The proliferation of quiet diesel submarines poses a significant threat to the Navy. SURTASS LFA provides a quantifiable improvement in the Navy's capabilities against this threat and markedly improves the survivability of U.S Naval forces in a hostile antisubmarine warfare (ASW) scenario.

The Navy's primary mission is to maintain, train, equip, and operate combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas. The Secretary of the Navy and Chief of Naval Operations have continually validated that ASW is a critical part of that mission—a mission that requires unfettered access to both the high seas and the littorals. In order to be prepared for all potential threats, the Navy must not only continue to test and train in the open ocean, but also in littoral environments[1].

Excerpts from Statement of Admiral William J. Fallon, U.S. Navy Vice Chief of Naval Operations before the Subcommittee on Readiness and Management Support United States Senate Armed Services Committee on Environmental Sustainment March 13, 2003
"………New ultra-quiet diesel-electric submarines armed with deadly torpedoes and cruise missiles are proliferating widely. New technologies such as these could significantly threaten our fleet as we deploy around the world to assure access for joint forces, project power from the sea, and maintain open sea-lanes for trade. To successfully defend against such threats, our Sailors must train realistically with the latest technology, including next-generation passive and active sonars." "The Navy has immediate need for SURTASS LFA. The Chief of Naval Operations has stated that Anti-Submarine Warfare (ASW) is essential to sea control and maritime dominance. Many nations are capable of employing submarines to deny access or significantly delay execution of joint and coalition operations in support of our vital interests. The submarine threat today is real and in some ways has become more challenging than during the Cold War. Of the approximately 500 non-U.S. submarines in the world, almost half that number are operated by non-allied nations. Of greatest concern are the new ultra-quiet diesel-electric submarines armed with deadly torpedoes and cruise missiles being produced by the People's Republic of China, Iran, and North Korea." "These diesel submarines are very difficult to detect outside the range at which they can launch attacks against U.S. and allied ships using passive sonar systems. Active systems like SURTASS LFA, when used in conjunction with other anti-submarine sensor and weapons systems, are necessary to detect, locate and destroy or avoid hostile submarines before they close within range of our forces. To ensure our Sailors are properly prepared to counter this growing submarine threat, we must make certain they train with the best systems available."

1.4 The Regulatory Process

SURTASS LFA sonar was the first Navy program for an operational system to complete the EIS process, which began on 18 July 1996, when the Navy published its Notice of Intent (NOI) in the

[1] Littoral Environment—The Navy defines littoral as the region that horizontally encompasses the land/watermass interface from fifty (50) statute miles ashore to two hundred (200) nautical miles at sea; extends vertically from the bottom of the ocean to the top of the atmosphere and from the land surface to the top of the atmosphere (Naval Oceanographic Office, 1999).

Federal Register (FR) (67 FR 37452) to prepare an EIS for SURTASS LFA Sonar under NEPA and Presidential Executive Order (EO) 12114 (Environmental Effects Abroad of Major Federal Actions). It culminated with the signing of the Record of Decision (ROD) by the Deputy Assistant Secretary of the Navy for Environment (DASN[E]) on 16 July 2002 (67 FR 48145).

On 12 August 1999, the Navy submitted an application to NMFS requesting authorization under the Marine Mammal Protection Act (MMPA) for the incidental harassment of marine mammals. On 22 October 1999, NMFS published an Advanced Notice of Proposed Rulemaking (ANPR) on the Navy's application requesting authorization under the MMPA for the incidental harassment of marine mammals (64 FR 57026). NMFS published the Proposed Rule (PR) on 19 March 2001 with public comment period initially ending on 3 May 2001 (66 FR 15375). Three public hearings were conducted by NMFS on the PR in Los Angeles, CA; Honolulu, HI; and Silver Spring, MD (26 April to 3 May 2001). The public comment period on the PR was extended to 31 May 2001. NMFS published the Final Rule under the MMPA in the *Federal Register* on 16 July 2002 (67 FR 46785). NMFS issued an annual Letter of Authorization (LOA) for the operation of SURTASS LFA Sonar on R/V *Cory Chouest* on 16 August 2002 (67 FR 55818), the same day that DASN(E) signed the ROD. When the PR was published in March 2001, NMFS received over 10,000 comments. Many of these comments concerned the rulemaking and the MMPA; however, many commenters used this forum to comment on the Final SURTASS LFA EIS, which was completed and made available to the public in January 2001. In coordination with NMFS, the Navy provided the first draft of the responses to these comments, while NMFS concentrated on responses relating to the rulemaking.

Based on the scientific analyses detailed in the Navy application and further supported by information and data contained in the Navy's Final EIS for SURTASS LFA sonar operations, NMFS concurred with the Navy that the incidental harassment of marine mammals resulting from SURTASS LFA sonar operations would result in the incidental harassment of only small numbers of marine mammals, have no more than a negligible impact on the affected marine mammal stocks or habitats and not have an unmitigable adverse impact on Arctic subsistence uses of marine mammals (67 FR 46783). This determination was supported by the highly effective mitigation measures; the interim operating restrictions implemented by NMFS under the LOA for SURTASS LFA sonar operations; and the Long Term Monitoring (LTM) program, including the research to be conducted therein. These included geographic operational restrictions, mitigation measures to minimize any potential for injury to marine mammals, monitoring and reporting of estimated risk to marine mammals, and supplemental research that will result in increased knowledge of marine mammal species, and the potential impacts of LF sound on these species. These latter measures offer the means for learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing the incidental harassment of marine mammals from anthropogenic underwater sound, and evaluating the possible long-term effects from exposing marine mammals to anthropogenic underwater sound.

1.5 Litigation

On 7 August 2002, the Natural Resources Defense Council, Humane Society of the United States and four other non-governmental organizations (NGOs) filed suit against the Navy and NMFS over SURTASS LFA sonar use and permitting. The Court recognized the Navy's National

Security requirements for operations to continue as the case proceeded. On 15 November 2002, the Court issued a tailored Preliminary Injunction for operations of LFA in a stipulated area in the northwest Pacific/Philippine Sea, and south and east of Japan. On 25 January 2003, the R/V *Cory Chouest*, having met all environmental compliance requirements, commenced testing and training in the northwest Pacific Ocean under the tailored Preliminary Injunction. Since then the R/V *Cory Chouest* has successfully completed numerous training operations. These operations were conducted within the area stipulated by the Court and under the mitigation requirements of the Final Rule and LOA issued by NMFS.

The Court issued its Summary Judgment ruling on the SURTASS LFA litigation on 26 August 2003. The Court found that deficiencies in the Defendants' (Navy and NMFS) compliance with the MMPA, ESA, and NEPA may put marine mammals and endangered species at risk from LFA operations. The Court, however, indicated that a total ban of employment of LFA would pose a hardship on the Navy's ability to protect National Security by ensuring military preparedness and the safety of those serving in the military from hostile submarines. The Court directed the parties to meet and confer on the scope of a tailored Permanent Injunction, which would allow for continued operation of the system. The exact scope of these areas was determined during mediation with the Court on 25 September 2003. The tailored Permanent Injunction was issued by the Court on 14 October 2003, allowing SURTASS LFA operations from both R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) in stipulated areas in the northwest Pacific Ocean/Philippine Sea, Sea of Japan, East China Sea, and South China Sea with certain year-round and seasonal restrictions. The culmination of this complex process to permit the reintroduction of SURTASS LFA sonar as a Fleet asset took seven years of dedicated effort by both Navy and NMFS personnel, as well as numerous independent scientists.

1.6 Supplemental Environmental Impact Statement

In anticipation of the Court's findings, DASN(E) provided direction to the Chief of Naval Operations (N7) on 11 April 2003 to develop a supplemental EIS (SEIS). The SEIS will provide additional information regarding the environment that could potentially be affected by employment of SURTASS LFA, focusing on identifying geographic areas and seasonal periods of high marine mammal abundance where the Navy intends to operate and utilizing that analysis to assist the Navy in selecting appropriate SURTASS LFA operating areas. Subsequent findings by the Court against the Navy and NMFS concerning its compliance to NEPA included addressing the following: 1) additional alternatives, including exclusion of biologically rich areas and designation of additional offshore biologically important areas (OBIAs); 2) additional monitoring and mitigation through the use of aerial or observational vessels for pre-operational surveys when operating close to shore; and 3) Navy's failure to adequately disclose to NMFS and analyze the impacts of low-frequency sound on fish.

On 26 September 2003, NMFS agreed to be a fully cooperating agency (as that term is defined by the Council on Environmental Quality [40 CFR 1501.6]) in the preparation and review of the SEIS.

2.0 MITIGATION MEASURES

On 14 August 2003 and 13 August 2004, NMFS issued to the Navy one-year LOAs for the USNS IMPECCABLE and R/V *Cory Chouest*, which are valid for an estimated 12 to 16 active sonar missions for the annual period of each LOA between the two ships (or equivalent shorter missions not to exceed 432 hours of transmit time between the two ships) during the period of effectiveness of these LOAs (16 August 2003 – 15 August 2005). Further, NMFS required that, under these LOAs, the Navy must minimize to the greatest extent practicable any adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence.

Mitigation protocols were initially set forth in the Final SURTASS LFA EIS, and modified by NMFS in their Final Rule and by the tailored Permanent Injunction issued by the Court in 14 October 2003 (discussed in Section 3.0). Under the conditions of the Final Rule and the LOAs, the mitigation measures discussed below have been implemented. Mitigation protocols set forth in the Record of Decision, NOAA/NFMS Final Rule and LOAs, and Court orders have been promulgated by the Chief of Naval Operations (N774) through executive direction messages of 12 August 2002, 31 October 2003, and 13 August 2004.

2.1 Final EIS and ROD Mitigation Measures

Mitigation, as defined by the Council on Environmental Quality, includes measures to minimize impacts by limiting the degree or magnitude of a proposed action and its implementation. In the Final SURTASS LFA EIS, the Navy analyzed several alternatives for the employment of SURTASS LFA sonar. Under Alternative 1 (the Navy’s “preferred alternative”) the Navy's purpose and need would be met and potential impacts reduced through the proposed mitigation measures to marine animals. Under this alternative, mitigation measures involve both geographic restrictions and operational measures (DON, 2001). These measures include:

- Ensuring that coastal waters within 22 km (12 nm) of shore are not exposed to SURTASS LFA sonar signal levels equal to or above 180 dB;
- Ensuring that no offshore biologically important areas are exposed to SURTASS LFA sonar signal levels equal to or above 180 dB during critical seasons;
- Minimizing exposure of marine mammals and sea turtles to SURTASS LFA sonar signal levels of 180 dB and above by monitoring for their presence and suspending transmissions when one or more of these species enters this 180-dB mitigation zone; and
- Assuring that no known recreational or commercial dive sites are subjected to LF sound pressure levels greater than 145 dB.

2.1.1 Geographic Restrictions

The following geographic restrictions apply to the employment of SURTASS LFA sonar:

- SURTASS LFA sound fields will be below 180 dB within 22 km (12 nm) of any coastlines, and in offshore areas outside this zone that have been determined by NMFS and the Navy to be biologically important (see Sections 2.1.1.1 and 2.1.1.2 below).

- When in the vicinity of known recreational or commercial dive sites (coastal or open ocean [blue water]), SURTASS LFA will be operated such that sound fields at those sites will not exceed 145 dB. Although human divers do not come under the jurisdiction of the MMPA, this restriction almost always supercedes the 180-dB criterion as the driving factor for placement of the SURTASS LFA vessel offshore and its LFA source operating parameters (e.g., source level, etc.).
- SURTASS LFA operators will estimate sound pressure levels prior to and during operations to provide the information necessary to modify operations, including delay or suspension of transmissions, in order not to exceed the 180-dB and 145-dB sound field criteria.

2.1.1.1 Offshore Biologically Important Areas

Offshore Biologically Important Areas (OBIAs) are areas of the world's oceans outside of 22 km (12 nm) of a coastline where marine animals of concern (those animals listed under the Endangered Species Act and/or marine mammals) congregate in high densities to carry out biologically important activities. These areas include:

- Migration corridors;
- Breeding and calving grounds; and
- Feeding grounds.

2.1.1.2 Designated OBIAs

There are four areas designated by the Navy and NMFS as offshore areas of critical biological importance for marine mammals in the Final SURTASS LFA EIS and Final Rule. These are:

- Shoreward of the 200-meter isobath off the North American East Coast, from 28 to 50 degrees North latitude, west of 40 degrees West longitude—year-round.
- Antarctic Convergence Zone, delimited by the following: 1) 30 to 80 degrees East longitude along the 45-degree South latitude; 2) 80 to 150 degrees East longitude along the 55-degree South latitude; 3) 150 degree East to 50 degree West longitude along the 60-degree South latitude; and 4) 50 degree West to 30 degree East longitude along the 50-deg South latitude—October through March (IUCN, 1995).
- Costa Rica Dome, centered at 9 degrees N latitude and 88 degrees W longitude—year round (Longhurst, 1998; Chandler et al., 1999).
- Penguin Bank, Hawaiian Archipelago, centered at 21 degrees North latitude and 157 degrees 30 minutes West longitude—November 1 through May 1.

None of these areas were within the authorized operational areas for LFA during the period of this report.

2.1.2 Monitoring Mitigation Requirements

Monitoring will take place during all operations to prevent injury to marine animals. This monitoring will take the form of three overlapping mitigation methods to maximize the probability of detection prior to an animal entering the LFA mitigation zone. These include:

- Visual monitoring for marine mammals and sea turtles from the vessel during daylight hours by personnel trained in their detection.
- Passive acoustic monitoring using the SURTASS passive horizontal line towed array to listen for sounds generated by marine mammals as an indicator of their presence when SURTASS is deployed.
- Active acoustic monitoring using the High Frequency Marine Mammal Monitoring (HF/M3) sonar to detect, locate, and track marine mammals that may pass close enough to the SURTASS LFA transmit array to enter the 180-dB sound field (LFA mitigation zone).

In accordance with the LOAs, monitoring mitigation measures must commence at least 30 minutes before the first SURTASS LFA transmission (or 30 minutes before sunrise for visual monitoring), continue between transmission pings, and continue for at least 15 minutes after completion of SURTASS LFA transmissions (or 30 minutes after sunset for visual monitoring), or if marine mammals are showing abnormal behavioral patterns, for a period of time until behavior patterns return to normal or conditions prevent continued observations.

If a marine mammal is detected within the area subjected to a sound pressure level of 180 dB or greater or within the 1-km (0.54-nm) buffer zone extending beyond the 180-dB LFA mitigation zone, SURTASS LFA transmissions will be immediately delayed or suspended. Transmissions will not commence or resume earlier than 15 minutes after: a) all marine mammals have left the area of the LFA mitigation and buffer zones; and b) there is no further detection of any marine mammal within these zones as determined by visual, passive or active acoustic monitoring.

The LFA mitigation zone, depicted in Figure 1, covers a volume ensonified to a level equal to or greater than 180 dB by the SURTASS LFA sonar transmit array. As discussed later in Section 2.2, NMFS has provided an interim operational restriction that extends the LFA mitigation zone by 1 km (0.54 nm), referred to as the buffer zone.

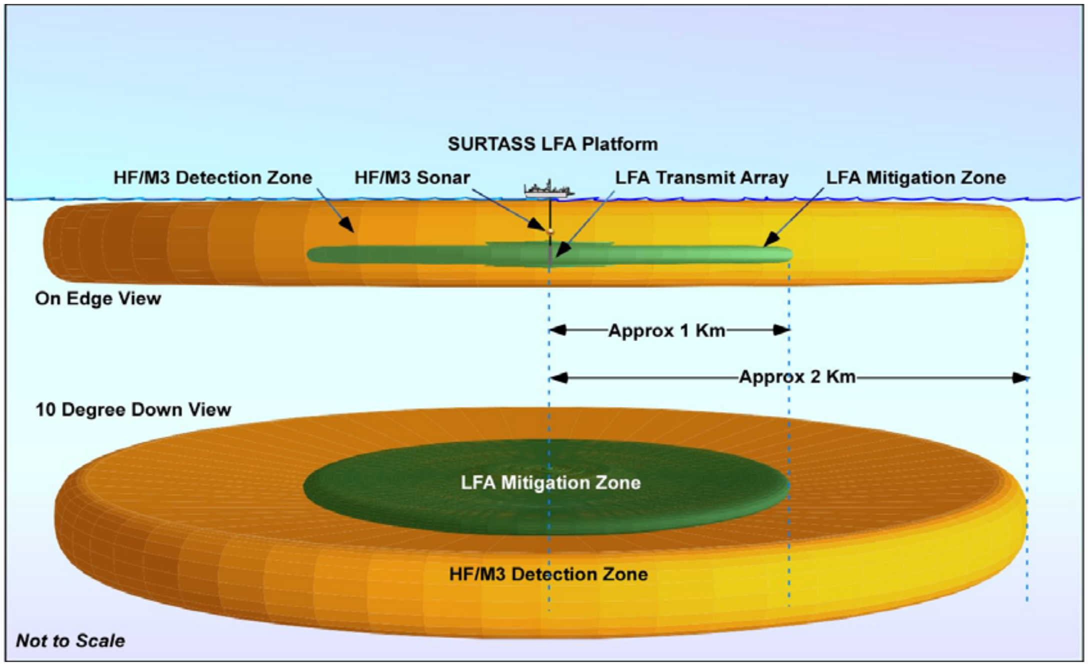


Figure 1. HF/M3 Sonar Detection and LFA Mitigation/Buffer Zones

2.1.2.1 Visual Monitoring

Visual observations are made by personnel trained in detecting and identifying marine mammals. Marine mammal biologists, qualified in conducting at-sea marine mammal visual monitoring from surface vessels, trained and qualified designated SURTASS LFA ship personnel to conduct at-sea visual monitoring. The objective of these observations is to maintain a track of marine mammals (or sea turtles) observed and to ensure that none approach the source close enough to enter the LFA mitigation and buffer zones. These personnel maintain a topside watch and marine mammal/sea turtle observation log during operations that employ SURTASS LFA in the active mode. The numbers and identification of marine mammals (or sea turtles) sighted, as well as any unusual behavior, are entered into the log. A designated ship's officer monitors the conduct of the visual watches and periodically reviews the log entries. There are two potential visual monitoring scenarios:

- If a marine mammal (or sea turtle) is sighted outside the LFA mitigation and buffer zones, the observer notifies the SURTASS LFA Military Detachment's (MILDET) Officer in Charge (OIC) or designated command duty officer (CDO) on watch. The OIC/CDO notifies the HF/M3 sonar operator to determine the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation and buffer zones, the OIC/CDO orders the delay or suspension of SURTASS LFA transmissions when the animal enters the buffer zone. If the animal is visually observed within 3 km (1.6 nm) and 45 degrees either side of the ship's bow, the OIC/CDO will order the delay or suspension of SURTASS LFA transmissions. The visual observer continues visual monitoring and recording until the animal is no longer seen.

- If a marine mammal (or sea turtle) is sighted within the LFA mitigation or buffer zones, the observer notifies the OIC/CDO, who orders the immediate delay or suspension of SURTASS LFA transmissions.

Marine mammal and sea turtle sightings are recorded in the log and provided as part of the Long Term Monitoring (LTM) Program to monitor for potential long-term environmental effects.

2.1.2.2 Passive Acoustic Monitoring

Passive acoustic monitoring is conducted when SURTASS is deployed, using the SURTASS towed horizontal line array to listen for vocalizing marine mammals as an indicator of their presence. If a detected sound is estimated to be from a marine mammal that may be potentially affected by SURTASS LFA, the technician notifies the OIC/CDO, who then alerts the HF/M3 sonar operator and visual observers. If prior to or during LFA transmissions, the OIC/CDO then orders the delay or suspension of LFA transmissions when the animal enters the buffer zone. Passively detected marine mammal vocalizations are recorded in a log and provided as part of the LTM Program to monitor for potential long-term environmental effects.

2.1.2.3 Active Acoustic Monitoring

The HF/M3 sonar was developed specifically to provide SURTASS LFA operators with a 24-hour, all weather capability to monitor the water column in the vicinity of the transmit array so that marine animals are not exposed to potentially injurious levels (180 dB or greater) from LFA. This sonar operates with a similar power level (220 dB), signal type and frequency (30 to 40 kHz) as high frequency “fish finder” type sonars used worldwide by both commercial and recreational fishermen. The HF/M3 sonar is located near the top of the LFA vertical line array. Its computer terminal for data acquisition, processing and display is located in the SURTASS Operations Center (SOC) onboard the SURTASS LFA vessel. The general characteristics of the HF/M3 sonar are provided in overview in the Final EIS (DON, 2001) and in detail in Ellison and Stein (2001) and Stein et al. (2001).

Analysis and testing of the HF/M3 sonar operating capabilities indicate that this system substantially increases the probability of detecting marine mammals that may pass close enough to the SURTASS LFA vessel to enter the 180-dB sound field (LFA mitigation zone) and provides excellent monitoring capability (particularly for medium to large marine mammals) beyond the LFA mitigation zone. The system’s ability to detect marine mammals of various sizes has been verified in several sea trials. HF/M3 testing, as documented in the Final EIS and NMFS’ Final Rule, has demonstrated a probability of detection above 95 percent within the LFA mitigation zone for most marine mammals (Ellison and Stein, 2001; Stein et al., 2001).

Figure 2 shows the single-ping probabilities of the HF/M3 sonar detecting various marine mammals as a function of range. These curves are based on: 1) the *in situ* measured interference (i.e., backscattering and false targets that cause target-like echoes on the sonar) observed during at-sea testing; 2) the *in situ* measured transmission loss (TL) from at-sea testing; and 3) the best available scientific data on marine mammal target strength (i.e., the expected ability of a marine mammal to “reflect” acoustic energy). The single-ping probabilities of detection show one facet of the effectiveness of the HF/M3 sonar as a mitigation tool because, in general, any marine mammal that enters the HF/M3 detection zone can be expected to be ensonified multiple times—approximately once every 50 seconds.

From Figure 2, it can be seen that for a 2.5-meter (8.2 ft) dolphin, Pd_1 (at 1,000 m/3,281 ft) = 43 percent. Using the formula $Pd_N = 1 - (1 - Pd_1)^N$, where N = number of animal ensonifications and Pd_1 = the single-ping probability of detection, it can be seen that for 2 ensonifications, $Pd_2 = 1 - (.57)^2 = 1 - 0.32 = 68$ percent. For 4 ensonifications, probability of detection increases to 90 percent, and for 5 ensonifications, probability of detection approaches 100 percent.

Probabilities of detection for a stationary whale of 20-meter (65.7-ft) length (e.g., a humpback) at various depths and ranges within the LFA mitigation zone are estimated to be from 98 percent (animal at 1-km [0.54-nm] range and 160-meter [525-ft] depth) to 72 percent (animal at 2-km [1.08-nm] range and 160-meter [525-ft] depth). Outside of the LFA mitigation zone, probabilities of detection for the same whale are estimated to be from 95 percent (animal at 1.5-km [0.81-nm] range and 200-meter [656-ft] depth) to 35 percent (animal at 500-meter [1,640-ft] range and 40-meter [131-ft] depth). Thus, an animal of this size approaching the LFA mitigation zone from any direction would have an extremely high likelihood of being detected before entering the zone.

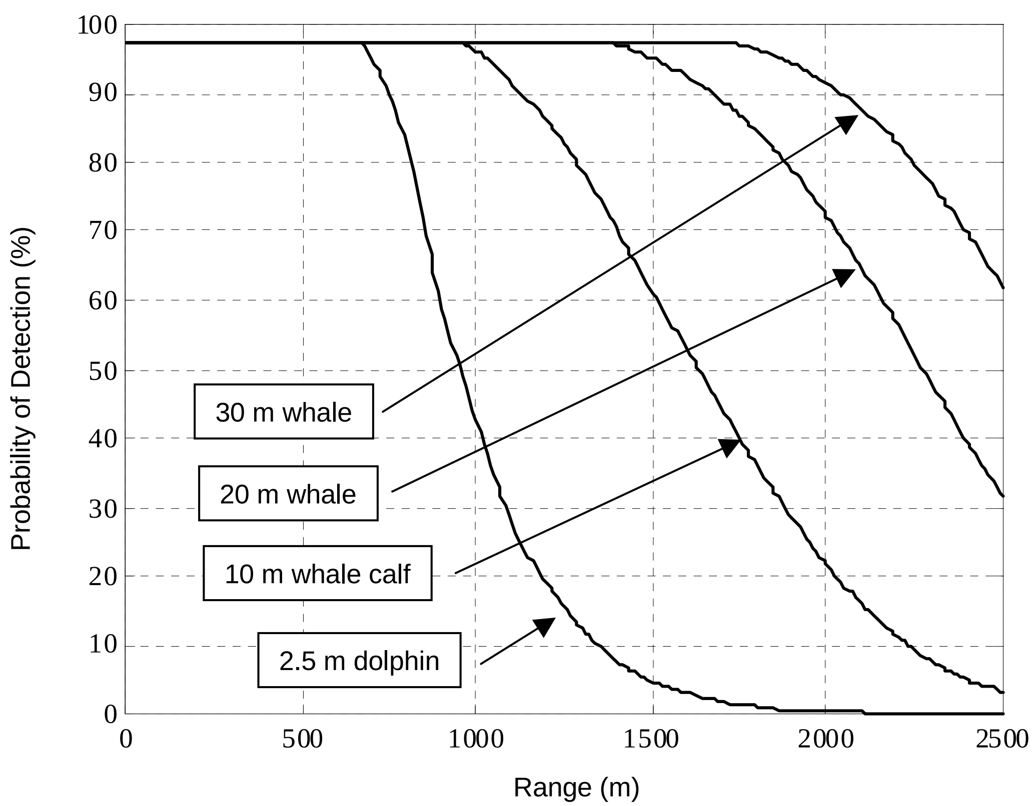


Figure 2. Probability of Detecting (on any given ping) Various Marine Mammals Swimming within the Search Beam of the HF/M3 Sonar System

2.1.3 Monitoring Mitigation Effectiveness

Based on the methodology from the SURTASS LFA Sonar Final EIS analyses (DoN, 2001), the SURTASS LFA sonar mitigation (monitoring) effectiveness (ME) can be represented as follows:

$$ME_{combined} = \text{function } (ME_{passive} + ME_{visual} + ME_{active})$$

Because the SURTASS passive array has limited bandwidth, a conservative value of 0.25 can be used for $ME_{passive}$.

Next, the contribution of visual monitoring was added to the passive acoustic monitoring effectiveness based on the following:

$$ME_{passive+visual} = ME_{passive} + [ME_{visual} \text{ x } (1 - ME_{passive})]$$

The mitigation effectiveness for surface visual monitoring ranges from 0.855 for baleen whales and many odontocetes, to 0.24 for the sperm whales, to 0.18 for Cuvier's beaked whales. For the Final EIS analyses, ME_{visual} was estimated from the lowest value (0.18) and then divided in half to account for the possible operation of SURTASS LFA sonar during nighttime, inclement weather, and high sea states. Therefore, ME_{visual} was set at 0.09. The overall combined passive plus visual monitoring mitigation effectiveness was calculated to be:

$$ME_{passive+visual} = 0.32.$$

Utilizing the active acoustic monitoring effectiveness of the HF/M3 sonar of 0.95, an overall, combined monitoring effectiveness is:

$$ME_{combined} = ME_{active} + [ME_{passive+visual} \text{ x } (1 – ME_{active})]$$

$$ME_{combined} = 0.98$$

2.2 Interim Operational Restrictions Under NMFS Final Rule and LOAs

Notwithstanding the effectiveness of the above mitigation measures, additional interim operational restrictions have been imposed by NMFS via the Final Rule and LOAs. These include the following:

- Until the Navy provides empirical and/or documentary evidence that resonance and/or tissue damage from SURTASS LFA sonar transmissions is unlikely to occur in marine mammals at levels less than 190 dB, NMFS has concluded that two interim operational restrictions to preclude the potential for injury due to resonance must be performed:

    - In order to ensure, to the greatest extent practicable, that marine mammals do not receive a sound pressure level (SPL) equal to, or greater than 180 dB, NMFS has amended the mitigation measures in the LOA to incorporate an interim operational restriction to include SURTASS LFA shutdown upon HF/M3 marine animal detection within a buffer zone that will extend 1 km (0.54 nm) from the outer limit of the 180-dB safety zone (LFA mitigation zone). This may extend up to 2 km (1.1 nm) from the vessel, depending on oceanographic conditions. At this distance, SPLs will be significantly less intense than 180 dB.

  - Operating frequency range of LFA will be restricted to 100 to 330 Hertz (Hz).

- In consultation with NOAA's National Marine Sanctuaries Program, waters within the boundaries of several national marine sanctuaries that are outside of 22 km (12 nm) of shore will not be exposed to SURTASS LFA sonar signal levels equal to or above 180 dB. These are either year-round or seasonal restrictions, depending on the specific sanctuary.

- In order to ensure that any harassment of marine mammals authorized under the LOA is at the lowest level practicable, missions will be planned to ensure that no greater than 12 percent of any marine mammal stock is incidentally harassed (as that term is defined in the MMPA) during the one-year effective period of the LOAs.

3.0 TAILORED PERMANENT INJUNCTION FOR SURTASS LFA OPERATIONS

During the period of this report, both SURTASS LFA sonar systems were operated under a tailored Permanent Injunction issued on 14 October 2003. Details of the authorized areas of operation are provided in APPENDIX A and shown in Figure 3. The associated maps provided in APPENDIX A reflect the following coastal exclusion zones wherein received sound pressure levels will not exceed 180 dB:

- Stipulated area within the Philippine Sea, a coastal exclusion zone of at least 60 nautical miles (nm) or 30 nm seaward of the 200-meter isobath, whichever is greater, except for waters adjacent to Taiwan, which shall be 30 nm; and
- All other areas, a coastal exclusion zone of at least 30 nm to include any islands.

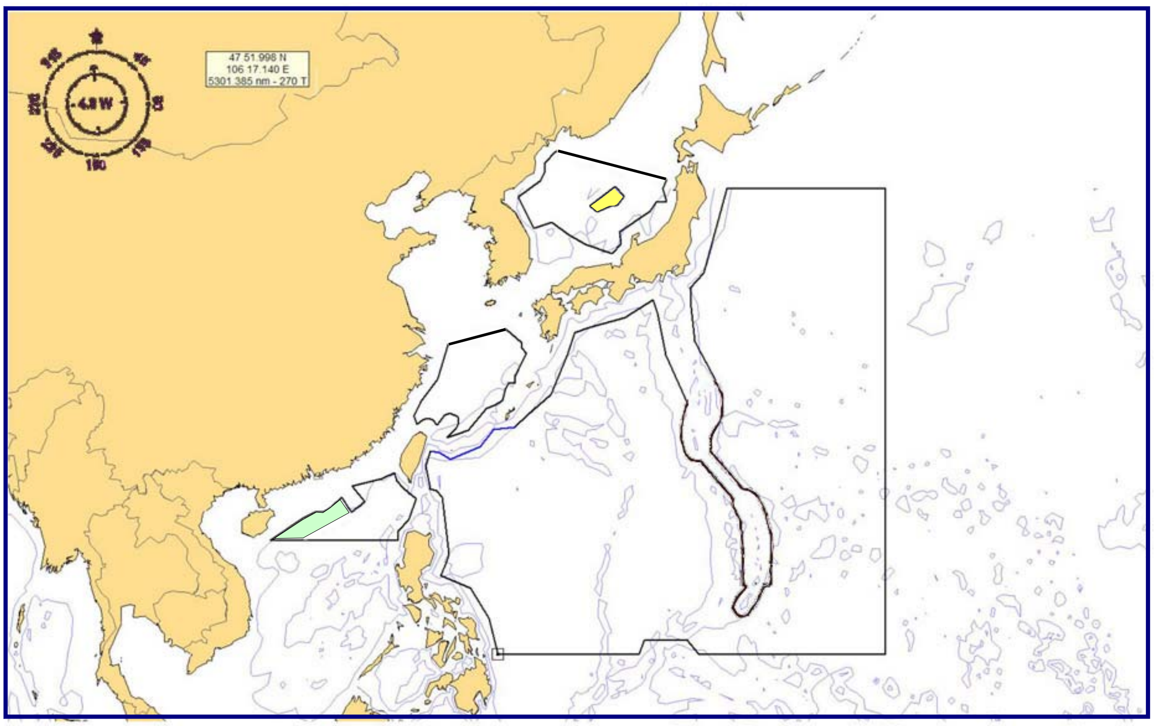


Figure 3. Tailored Permanent Injunction Stipulated LFA Operating Areas

4.0 SUMMARY OF SURTASS LFA OPERATIONS FOR THIRD YEAR ANNUAL REPORT

Under 50 CFR 216.186(b) and LOA Condition 8(b), this annual report consists of an unclassified summary of the quarterly reports as of 90 days prior to the expiration of the current LOAs. Therefore, this annual report will cover only those quarterly reports submitted subsequent to the due date of the last annual report in May 2004. This annual report will include the third and fourth quarterly reports under the second LOA and first and second quarterly reports under the third year LOAs for the USNS IMPECCABLE and R/V *Cory Chouest*, for the period of 16 February 2004 through 15 February 2005. The third and fourth quarters for the third year LOAs, along with the first and second quarters of the fourth year LOAs, will be reported in the subsequent annual report in 2006.

4.1 SURTASS LFA Operations for Third Annual Report

Under the conditions of the Court's tailored Permanent Injunction, two SURTASS LFA sonar systems are currently operating under LOAs issued by NMFS for the period 16 August 2004 to 15 August 2005. The LFA system onboard R/V *Cory Chouest* commenced reintroduction to the Fleet in January 2003 and is presently operating in the western North Pacific. The second system onboard USNS IMPECCABLE (T-AGOS 23) commenced sea trials in late February 2004 and is expected to be ready for full Fleet operations in FY 05. This report includes four training missions from the R/V *Cory Chouest* and five training mission for the USNS IMPECCABLE.

The purposes of the training missions are to provide fully functional hardware and software, extensive training, job experience, and operational/system monitoring in a variety of LFA mission scenarios and acoustic environments.

The keys to SURTASS LFA success are:

- Assuring LFA Transmit System (LTS) reliability, maintainability, and availability through system maintenance, system shakedown and correction of deficiencies, and LTS training.
- Assuring the system hardware and software (processing, communications, support systems) reliability, maintainability, and availability through system interface testing, system function testing, system operational testing, system load testing, and the correction of deficiencies.
- Training of SURTASS LFA crew through at-sea training in diverse environments and missions.
- Updating the SURTASS LFA Employment Guidelines documentation.
- Testing and certification of the system performance in a variety of missions and environments. The environments should range from familiar acoustic environments during system shakedown to operationally significant environments for crew training.
- Successful system employment in a variety of tactical and strategic scenarios in diverse acoustic environments.
- Operational training with the HF/M3 sonar and compliance to the mitigation requirements.

4.1.1 R/V *Cory Chouest* Training Missions

Training missions for the R/V *Cory Chouest* consisted of four missions covering a period of 38.9 days with 93.3 hours of transmissions by the LFA array and included the operation of the HF/M3 sonar and compliance to the mitigation requirements. These missions occurred in the Philippine Sea during the winter and spring of 2004.

4.1.2 USNS IMPECCABLE Training Missions

Training missions for the USNS IMPECAABLE consisted of five missions covering a period of 26.2 days with 63.0 hours of transmissions by the LFA array and included the operation of the HF/M3 sonar and compliance to the mitigation requirements. These missions occurred in the Philippine Sea and northwest Pacific Ocean during the spring and summer of 2004.

4.2 Estimates of Marine Mammal Stocks Potentially Affected

In its annual LOA applications, the Navy provides estimates of the percentage of marine mammal stocks that could potentially be affected in the biogeographic regions of proposed LFA operations for the 12-month period of the LOA(s). In this annual report, the Navy provides a post-operational assessment of whether incidental harassment occurred within the LFA mitigation and buffer zones and estimates of the percentages of marine mammal stocks possibly harassed incidentally using predictive modeling based on dates/times/location of operations, system characteristics, oceanographic/environmental conditions, and animal demographics. The basis for the methodology used for the acoustic modeling to analyze risk and produce the incidental harassment estimates was essentially the scientific analysis process used in the SURTASS LFA Final EIS (DON, 2001) and detailed in the Navy's second year application to NMFS for LOAs (DON, 2003).

During the period of this annual report, LFA operational missions were conducted areas generally defined as Sites 1, 2, and 3 in the LOA applications (DON, 2003; 2004) and Provinces 53 and 56 as defined in the Final Rule section 216.180.

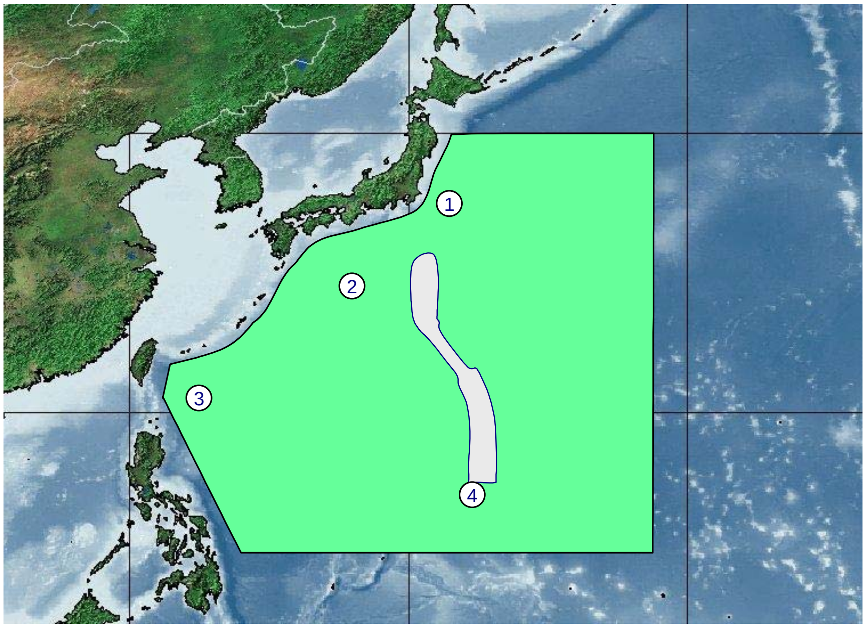
4.2.1 Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected

Overall planning for operations during the LOA periods was based first on the identification of the general ocean areas where testing, training and routine LFA operations were desired, development of criteria for these mission areas, and then the determination of the best operational sites and seasons within these mission areas that would have the least potential for impacts on marine mammals while meeting the Navy's operational requirements. Potential mission sites within each mission area were then analyzed with regard to spatial and temporal factors. Based on operational requirements for LFA and the tailored Permanent Injunction, the general ocean areas were within the Philippine Sea, northwest Pacific Ocean, Sea of Japan, East China Sea and South China Sea as shown in APPENDIX A. Marine mammal density and stock/abundance estimates were then assembled.

APPENDIX B provides information on how the density and stock/abundance estimates were derived for the operational areas shown in Figure 4. These data were derived from best available published source documentation, and provided general area information for mission areas, with species-specific information on the animals that could potentially occur in that areas, including estimates for their stock/abundance and density. Animal demographics (stocks and densities) are based on current literature reviews of the western North Pacific Ocean as cited in APPENDIX B.

Analyses for pre-operational estimates were performed at nominal potential operational sites, encompassing all four seasons, which provide a very conservative estimate of the potential for impacts to marine mammal stocks in those provinces where operations were proposed.

Figure 4 shows the sites in the Philippine Sea area where operations occurred. Tables 1 through 3 provide pre-operational risk estimates for marine mammal stocks in these operating areas (Sites 1 through 3) as presented in the Navy's application for LOAs (DON, 2004). These values supported the conclusion that all risk estimates for marine mammal stocks were below—for most cases, well below—the criteria delineated by NMFS in the Final Rule (67 FR 46785-89). Upon completion of the missions under the requested authorization, these estimates were refined and submitted to NMFS under the reporting requirements of the Final Rule and the conditions of the LOAs, as issued. The pre-operational estimates were based on the third year LOA application (DON, 2004) for a nominal 9-day mission lengths.



Note: For Illustrative Purposes Only; Not to Scale

Figure 4. SURTASS LFA Operating Areas during This Annual Report Period

Table 1. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 1

East of Japan					
Site 1	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Blue whale	60	9250	0.25	0.00
	Fin whale	60	9250	0.25	0.00
	Sei whale	180	37000	0.19	0.00
	Bryde's whale	180	22000	0.31	0.00
	Minke whale	1080	25000	1.76	0.00
	N. Pacific right whale	3	922	0.12	0.00
	Sperm whale	300	102112	0.10	0.00
	Kogia	930	166553	0.20	0.00
	Ginkgo-toothed beaked whale	30	22799	0.24	0.00
	Cuvier's beaked whale	324	90725	0.64	0.00
	Baird's beaked whale	87	8000	1.96	0.00
	Hubbs' beaked whale	30	22799	0.24	0.00
	False killer whale	1080	16668	2.95	0.00
	Pygmy killer whale	630	30214	0.95	0.00
	Melon-headed whale	60	15000	0.17	0.00
	Short-finned pilot whale	3840	53608	3.09	0.00
	Spinner dolphin	42	1015059	0.01	0.00
	Fraser's dolphin	1200	220789	0.27	0.00
	Common dolphin	22830	3286163	0.35	0.00
	Bottlenose dolphin	5130	168791	1.60	0.00
	Pantropical spotted dolphin	7770	438064	0.89	0.00
	Rough-toothed dolphin	1770	145729	0.61	0.00
	Striped dolphin	3330	570038	0.29	0.00
	Risso's dolphin	2910	83289	1.84	0.00
	Pacific white-sided dolphin	2460	100757	1.23	0.00

Table 2. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 2

North Philippine Sea					
Site 2	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Minke whale	1080	25000	1.45	0.00
	Bryde's whale	180	22000	0.27	0.00
	N. Pacific right whale	3	922	0.12	0.00
	Sperm whale	300	102112	0.09	0.00
	Kogia	930	166553	0.17	0.00
	Ginkgo-toothed beaked whale	28	22799	0.22	0.00
	Blainville's beaked whale	28	8032	0.63	0.00
	Cuvier's beaked whale	1620	90725	0.60	0.00
	Killer whale	120	12256	0.35	0.00
	Pygmy killer whale	126	30241	0.75	0.00
	False killer whale	870	16668	1.88	0.00
	Short-finned pilot whale	4590	53608	3.08	0.00
	Bottlenose dolphin	4380	168791	1.12	0.00
	Risso's dolphin	3180	83289	1.65	0.00
	Pantropical spotted dolphin	4110	438064	0.36	0.00
	Striped dolphin	9870	570038	0.66	0.00

Table 3. Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 3

West Philippine Sea					
Site 3	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	60	9250	0.30	0.00
	Bryde's whale	180	22000	0.37	0.00
	Minke whale	540	25000	0.98	0.00
	Humpback whale (winter only)	0	394	0.00	0.00
	Sperm whale	300	102112	0.11	0.00
	Kogia	510	166553	0.11	0.00
	Ginkgo-toothed beaked whale	150	22799	0.25	0.00
	Cuvier's beaked whale	90	90725	0.04	0.00
	Blainville's beaked whale	150	8032	0.72	0.00
	False killer whale	870	16668	2.38	0.00
	Pygmy killer whale	630	30241	0.95	0.00
	Melon-headed whale	4290	36770	5.32	0.00
	Short-finned pilot whale	2280	53608	1.94	0.00
	Spinner dolphin	150	1015059	0.01	0.00
	Fraser's dolphin	1200	220789	0.27	0.00
	Common dolphin	16860	3286163	0.26	0.00
	Bottlenose dolphin	4380	168791	1.37	0.00
	Pantropical spotted dolphin	4110	438064	0.47	0.00
	Rough-toothed dolphin	1770	145729	0.61	0.00
	Striped dolphin	4920	570038	0.44	0.00
	Risso's dolphin	3180	83289	2.02	0.00
	Pacific white-sided dolphin	7350	100757	3.68	0.00

4.2.2 Post-Operational Estimates of Marine Mammal Stocks Potentially Affected

SURTASS LFA operations during the period of this annual report comprised nine missions totaling 65.1 days of operations with 156.3 hours of active transmissions by the LFA array. The general areas of these missions were the Philippine Sea in LOA Provinces 53 and 56, depicted in Figure 4 as Sites 1, 2, and 3. There were no operations in the area of Site 4.

Tables 4 through 6 provide post-operational estimates of the percentage of marine mammal stocks affected by the 65.1 days of SURTASS LFA sonar operations both within and outside the 180-dB mitigation zone. The same methodology was utilized as that used for the pre-operational analysis discussed above in Sections 4.2 and 4.2.1, except that the durations of each mission were based on actual transmission times and oceanographic environmental conditions were based on the date/time/location of the actual operations. Animal density and stock/abundance estimates were updated based on current literature reviews of the western North Pacific Ocean operational areas shown in Figure 4 (see APPENDIX B). Updated data in Tables 4 through 6 are shown in italics.

Table 4. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 1

East of Japan 2 Missions					
Site 1	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Blue whale	60	9250	0.14	0.00
	Fin whale	60	9250	0.14	0.00
	Sei whale	180	37000	0.10	0.00
	Bryde's whale	180	22000	0.17	0.00
	Minke whale	1080	25000	0.94	0.00
	N. Pacific right whale	3	922	0.07	0.00
	Sperm whale	300	102112	0.05	0.00
	Kogia	930	350553	0.05	0.00
	Ginkgo-toothed beaked whale	150	22799	0.13	0.00
	Cuvier's beaked whale	1620	90725	0.35	0.00
	Baird's beaked whale	87	8000	0.14	0.00
	Hubbs' beaked whale	150	22799	0.13	0.00
	False killer whale	1080	16668	1.58	0.00
	Pygmy killer whale	630	30214	0.51	0.00
	Melon-headed whale	60	15000	0.19	0.00
	Short-finned pilot whale	3840	53608	1.67	0.00
	Spinner dolphin	150	1015059	0.00	0.00
	Fraser's dolphin	1200	220789	0.15	0.00
	Common dolphin	22830	3286163	0.19	0.00
	Bottlenose dolphin	5130	168791	0.86	0.00
	Pantropical spotted dolphin	7770	438064	0.48	0.00
	Rough-toothed dolphin	1770	145729	0.33	0.00
	Striped dolphin	3330	570038	0.15	0.00
	Risso's dolphin	2910	83289	0.99	0.00
	Pacific white-sided dolphin	2460	67769	0.99	0.00

Table 5. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 2

North Philippine Sea 2 Missions					
Site 2	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Minke whale	1080	25000	0.70	0.00
	Bryde's whale	180	22000	0.14	0.00
	N. Pacific right whale	3	922	0.05	0.00
	Sperm whale	300	102112	0.04	0.00
	Kogia	930	166553	0.07	0.00
	Ginkgo-toothed beaked whale	150	22799	0.11	0.00
	Blainville's beaked whale	150	8032	0.30	0.00
	Cuvier's beaked whale	1620	90725	0.29	0.00
	Killer whale	120	12256	0.17	0.00
	Pygmy killer whale	630	30241	0.37	0.00
	False killer whale	870	16668	0.92	0.00
	Short-finned pilot whale	4590	53608	1.50	0.00
	Bottlenose dolphin	4380	168791	0.55	0.00
	Risso's dolphin	3180	83289	0.80	0.00
	Pantropical spotted dolphin	4110	438064	0.18	0.00
	Striped dolphin	9870	570038	0.33	0.00
	Melon-headed	*360*	*36770*	*0.17*	*0.00*
	Common dolphin	*16860*	*3286163*	*0.10*	*0.00*
	Spinner dolphin	*150*	*1015059*	*0.00*	*0.00*
	Rough-toothed dolphin	*1770*	*145729*	*0.23*	*0.00*
	Frazer's dolphin	*1200*	*220789*	*0.10*	*0.00*
	Pacific white-sided dolphin	*3570*	*67769*	*0.99*	*0.00*

Note: Entries in italics were added based on best available data developed after the submission of the application for the third LOA.

Table 6. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected In Site 3

West Philippine Sea 5 Missions					
Site 3	**Animal**	**# Animals in Area**	**# Animals Stock**	**% Affected 120-180 dB**	**% Affected (w/mit) ≥ 180 dB**
	Fin whale	60	9250	0.53	0.00
	Bryde's whale	180	22000	0.67	0.00
	Minke whale	540	25000	1.75	0.00
	Humpback whale (winter only)	0	394	3.27	0.00
	Sperm whale	300	102112	0.19	0.00
	Kogia	510	350553	0.09	0.00
	Ginkgo-toothed beaked whale	150	22799	0.44	0.00
	Cuvier's beaked whale	90	90725	0.07	0.00
	Blainville's beaked whale	150	8032	1.27	0.00
	False killer whale	870	16668	4.22	0.00
	Pygmy killer whale	630	30241	1.69	0.00
	Melon-headed whale	4290	36770	9.46	0.00
	Short-finned pilot whale	2280	53608	3.46	0.00
	Spinner dolphin	150	1015059	0.01	0.00
	Fraser's dolphin	1200	220789	0.49	0.00
	Common dolphin	16860	3286163	0.46	0.00
	Bottlenose dolphin	4380	168791	2.45	0.00
	Pantropical spotted dolphin	4110	438064	0.84	0.00
	Rough-toothed dolphin	1770	145729	1.10	0.00
	Striped dolphin	4920	570038	0.77	0.00
	Risso's dolphin	3180	83289	3.60	0.00
	Pacific white-sided dolphin	7350	100757	9.72	0.00

4.2.3 Summary of Results

The percentage of marine mammal stocks estimated to be exposed between 120 and 180 dB for both pre- and post-operational estimates are shown in Tables 1 through 6. Tables 4 through 6 demonstrate that the post-operational estimates are below the 12 percent for any marine mammal stock, the maximum percentage authorized in LOA Condition 6 (g).

The post-operational incidental harassment assessments in Tables 4 through 6 demonstrate that there were no marine mammal exposures to received levels at or above 180 dB. These results are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Section 4.3. In addition, a review of recent stranding data from the National Science Museum of Tokyo, Japan and Internet sources did not indicate any stranding events associated with the times and locations of LFA operations.

4.3 Mitigation Effectiveness

Under LOA Condition 8(b)(i) the following assessment of the effectiveness of the mitigation measures is provided. Due to the limited operations (nine missions), it is not possible to make any recommendations for improvements at this time.

4.3.1 LFA Mitigation and Buffer Zones

During the missions, the minimum radial distance to the safety zone from the LFA array was 1 km (0.54 nm). Therefore, the safety and buffer zones comprised a 2-km (1.08-nm) radius.

4.3.2 Visual Monitoring

Visual observers, trained in marine mammal identification, were posted as specified in LOA Condition 7(a)(i) and CNO executive directives (see Section 2.0). The personnel responsible for marine animal visual monitoring were formally trained in the proper methods, procedures, and protocols required to detect and to identify marine animals in accordance with Condition 7(c) of the LOAs. During the nine missions, no sightings of marine animals were noted.

4.3.3 Passive Acoustic Monitoring

The embarked military detachment (MILDET) and system support engineers monitored the SURTASS passive displays for marine mammal vocalizations as specified in LOA Condition 7(a)(ii). During the nine missions, no marine mammal vocalizations were identified, which might have approached the mitigation (safety) and buffer zones.

4.3.4 Active Acoustic Monitoring

The HF/M3 sonar was operated continuously during the course of the missions in accordance with LOA Conditions 6(c) and 7(a)(iii). The HF/M3 sonar was “ramped-up” prior to operations as required. During seven of the nine missions, there were twelve HF/M3 alerts that were identified as possible marine mammal or sea turtle detections. No additional correlating data were available to further verify, identify, or clarify these detections. Because these detections met the minimum criterion for identification of a marine animal (two HF/M3 detection alerts within six seconds), the requisite protocols were followed and LFA transmissions were suspended or delayed due to mitigation protocols.

4.3.5 Delay/Suspension of Operations

Because the HF/M3 sonar detections noted above met the minimum shutdown criteria (two HF/M3 detection alerts within six seconds), the requisite protocols were followed under LOA Condition 6(b). LFA transmissions were suspended on twelve occasions. In addition, during one mission there were two suspensions of operations due to HF/M3 sonar software failures.

4.4 Assessment of Long-Term Effects and Estimated Cumulative Impacts

Only nine missions were conducted during the period of this report. Thus, no assessment of long-term effects or estimated cumulative impacts are possible at this time.

5.0 LONG TERM MONITORING AND RESEARCH

As part of its continuing commitment to protect the environment, the Navy is carrying out a Long Term Monitoring (LTM) Program to assess and analyze the potential for effects of the employment of SURTASS LFA on the marine environment. The LTM Program consists of two parts.

5.1 Reporting Requirements Under the Final Rule and Letters of Authorization

The first part of the LTM Program consists of NMFS-directed reports under the MMPA Final Rule and LOAs. These reports provide information for assessments of whether incidental harassment of marine mammals occurred within the SURTASS LFA mitigation and buffer zones during operations, based upon data from the monitoring mitigation (visual, passive acoustic, active acoustic). Data analysis from the LTM Program and post-operation acoustic information are utilized to estimate the percent of marine mammal stocks potentially exposed to SURTASS LFA received levels below 180 dB.

During routine operations of SURTASS LFA, technical and environmental data are collected and recorded. These include data from visual and acoustic monitoring, ocean environmental measurements, and technical operational inputs. As part of the LTM Program and as stipulated in the MMPA Final Rule and LOAs, the following reports are required:

- Mission reports are provided to NMFS on a quarterly basis for each vessel, including all active-mode missions that have been completed 30 days or more prior to the date of the deadline for the report.
- The Navy submits annual reports to NMFS 90 days prior to expiration of the LOAs.
- The Navy will provide a final comprehensive report analyzing any impacts of SURTASS LFA sonar on marine mammal stocks during the 5-year period of the regulations.

5.2 Long-Term Independent Scientific Research Efforts

The second part of the LTM Program involves long-term independent scientific research efforts on topics designed to fill data gaps and further the overall understanding of the effects of anthropogenic sound and noise on the marine environment. The Navy believes that the research and analyses contained in the SURTASS LFA Final EIS were sufficient to permit informed decision-making regarding the employment of SURTASS LFA sonar. However, it is prudent to continue appropriate underwater acoustic research. As noted earlier in this report, a supplemental EIS (SEIS) will be developed to provide additional information regarding the environment that could potentially be affected by employment of SURTASS LFA and to address concerns raised in findings by the Court concerning compliance to NEPA, MMPA and ESA. The results of the LTM Program will augment the SEIS analysis by filling some data gaps concerning marine mammals and the effects of anthropogenic sound and noise on the marine environment.

Specific independent scientific research efforts pertaining to the LTM Program are discussed in the following sections. All research will comply with applicable laws and regulations, as determined during the planning phase of the research.

5.2.1 Northeast Pacific Gray Whale Scientific Research Project

Scientific Solutions, Inc. (SSI) was granted a Scientific Research Permit by NMFS to study the effectiveness of the new Integrated Marine Mammal Monitoring And Protection System (IMAPS) sonar. The indicator species were planned to be gray whales migrating close to the coast of California (San Luis Obispo County). The goal of the research was to develop a sonar system that would help the oil industry and Navy spot whales so they could halt underwater explosions, the firing of powerful air guns, or sonar system transmissions (other than SURTASS LFA, which already incorporated the HF/M3 sonar in its monitoring mitigation). A collection of animal-welfare groups filed suit in the 9th District Court of California in January 2004. The Court denied an injunction. The research continued and the 2004 work was completed by the end of January 2004.

No obvious responses of whales to the sonar were observed in the field. Strong and obvious responses of gray whales were observed in the presence of killer whales. Statistical analysis is ongoing to determine if there was a reaction to the sonar that occurred, but was too small to be detected in the field. Preliminary analysis of the sonar tracking data indicate that the IMAPS sonar did successfully track the whales.

5.2.2 IUSS Playback Experiments

The objectives of this LTM research project are to:

- Improve understanding of marine mammal responses to anthropogenic sounds under various environmental (e.g., ambient noise) conditions, while controlling for natural variables such as time of day, time of year, behavioral context, ecological context, physical oceanographic conditions, and biological oceanographic conditions;
- Produce scientific documentation for environmental/scientific journals for peer review;
- Assess and quantify the capability of integrated undersea surveillance system (IUSS) assets and supplementary oceanographic recording devices to monitor whale activity on a short-term and long-term basis, and provide focused data collection support for a scientifically-directed experiment; and
- Support the Navy’s environmental compliance in the use of sound in undersea warfare.

Data from various integrated undersea surveillance system assets are being collected, processed, and analyzed to monitor marine mammal responses to external anthropogenic sound stimuli from surface and subsurface assets under various environmental conditions in the United Kingdom (UK) northwest approaches. Scientists from the Laboratory of Ornithology, Cornell University are leading the performance of these experiments.

5.2.3 Beaked Whale Controlled Exposure Experiments

Although beaked whales are believed to be less sensitive to LF sounds than the baleen whale species studied during the SURTASS LFA Low Frequency Sound Scientific Research Program (LFS SRP), enough questions exist that these species should be the focus of international field research. Currently, advance scoping and planning are underway to ascertain where, when and how a beaked whale controlled exposure experiment (CEE) may be conducted. These experiments must be planned carefully, with scientific workshops and proper permitting. Broad support from government oversight/regulatory agencies, academia, industry, and non-government organizations is needed. The scientific terms of reference for a group of scientists to draft a strategic plan of research for beaked whale CEEs should be available by October 2005, to possibly be implemented via a request for proposals in early 2006.

Because beaked whales appear to be more sensitive to acoustic sources other than LFA, this research should primarily be funded through ongoing international environmental programs. These include the Strategic Environmental Research and Development Program (SERDP), with possible Navy support through the Office of Naval Research (ONR); and international organizations such as the European Science Foundation (ESF), the UK's Defence Science and Technology Laboratory, and the oil and gas industry.

5.2.4 Fish Controlled Exposure Experiments

The Court noted in its Opinion that the Navy had failed to adequately determine the potential impact of low frequency sound on fish. In order to address this issue, the Navy has funded the University of Maryland to perform independent, scientific fish CEEs to determine the short and long term effects of LFA exposure on several species of fish with emphasis on the auditory system. The objectives of the fish CEEs include:

- Determining any effects in fish species with differences in auditory structures;
- Testing hearing immediately after exposure to determine if there is any temporary threshold shift (TTS) or permanent threshold shift (PTS);
- Measuring longer-term effects on hearing and if there is recovery from TTS;
- Ascertaining any effects of LFA sonar on the inner ear structures;
- Assessing any gross pathological changes in other organ systems that may be associated with sonar exposure;
- Evaluating non-auditory tissues using histopathology to determine if there is any effect at the cellular level; and
- Observing the behavior of fish during ensonification to determine their immediate response to exposure to the LFA sound.

The principal investigator (PI) for this experiment is the Director, Neuroscience and Cognitive Science Program, Department of Biology, University of Maryland. Pathology of the fish to determine risk damage thresholds is being performed by the Director, University of Maryland Aquatic Pathobiology Laboratory, Department of Veterinary Medicine. These experiments commenced in March 2004 at Seneca Lake, New York. Initial tests were conducted on rainbow trout (a salmonid and hearing non-specialist) and channel catfish (a hearing specialist). Both species are indigenous to Seneca Lake.

The fish CEEs are relevant research under the LTM Program because:

- Fish ears are anatomically similar mammalian ears;
- Risk damage threshold experiments cannot be performed on marine mammals for numerous reasons, and the injury thresholds determined for fish can potentially provide valuable information concerning marine mammal injury thresholds; and
- Fish are prey species for many marine mammals and, as such, any potential effects to fish stocks has the potential to affect marine mammals.

Tests have been conducted with several different exposures, including baseline, control, and maximum signal level (received level [RL]) of approximately 193 dB (RL), 187 dB (RL), 181 dB (RL); and 193 dB (RL) at twice the exposure time (all received levels are re: 1 µPa).

Measurements were made of hearing sensitivity using auditory brainstem response (ABR), effects on the inner ear structure, and general pathology and histopathology of non-auditory tissues. To date, test series have been completed on rainbow trout and channel catfish. There was no loss of any animals due to exposure during the LFA tests. Preliminary analysis of the behavior of fish before, during, and after sound stimulation showed initial startle responses at the onset of stimulation, but fish seemed to become acclimated to the sound with behavior returning to normal pre-stimulation activity within a few minutes after the onset. The rainbow trout showed hearing loss at 400 Hz but not at 100 and 200 Hz. However, because fishes do not have frequency mapping in their ears, as found in mammals, it is reasonable to expect that hearing loss could be at any frequency within the hearing range of fishes. However, it is not clear why loss of hearing only occurred at one frequency in the rainbow trout and not at others. Channel catfish showed hearing loss on the day of exposure that covered all test frequencies. Preliminary recovery data showed that hearing recovery occurred within 96 hours for rainbow trout and within 48 hours for catfish. Preliminary analysis of the swim bladder and other body tissues showed no effect from exposure to LFA sounds.

Because there are several gaps in the data, additional series of tests are being conducted during the summer and fall of 2005 order to have a more complete idea of the effect of LFA sounds on fishes.

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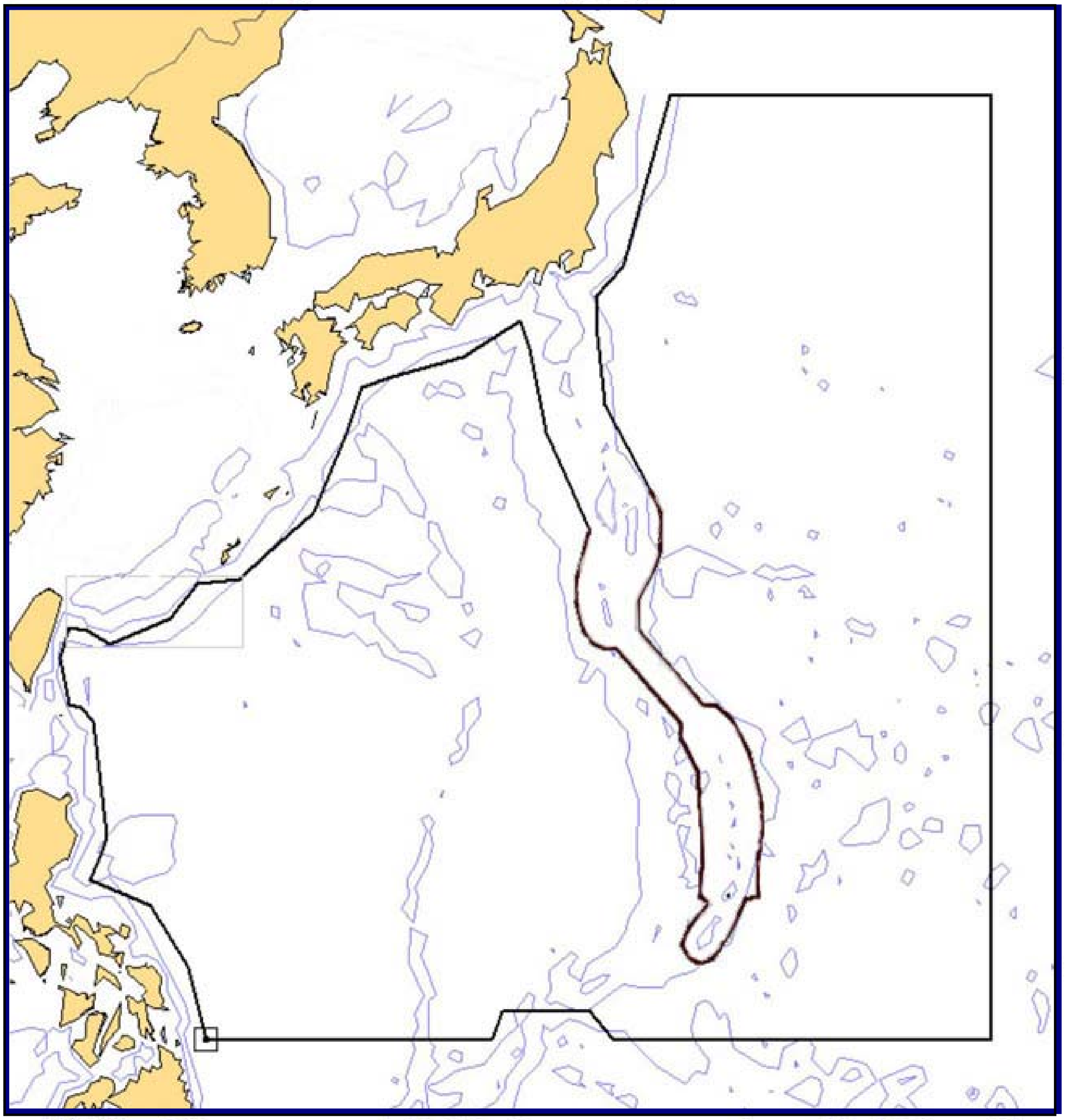
APPENDIX A

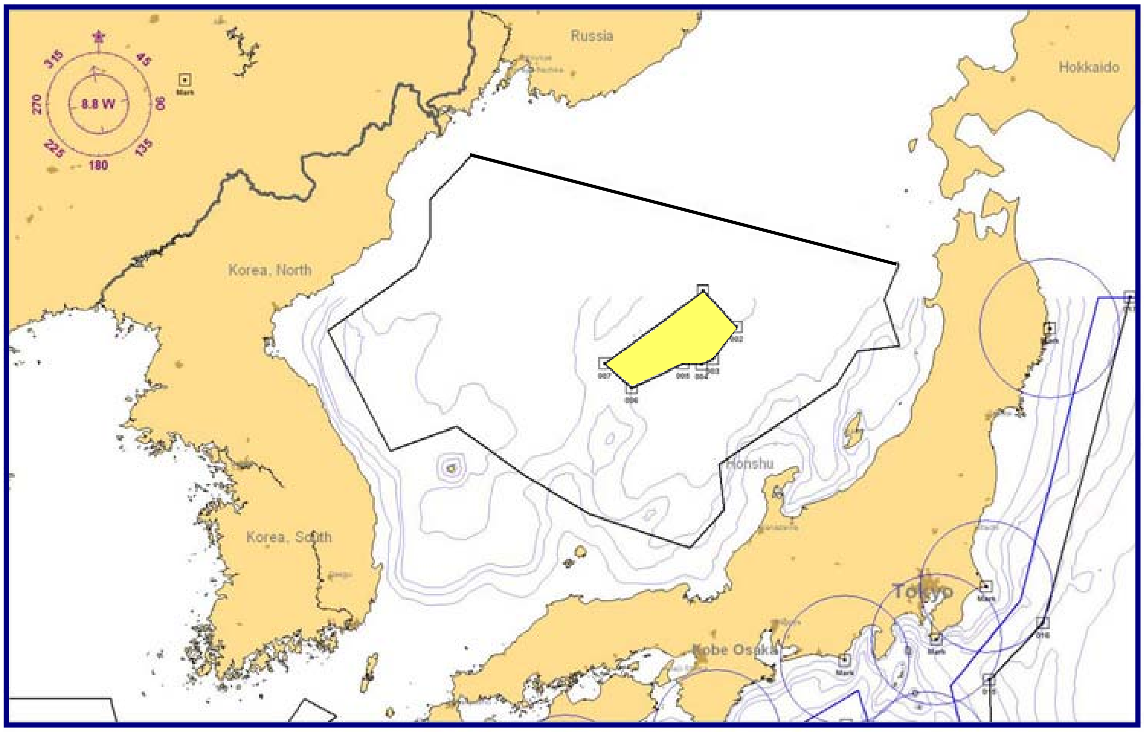
TAILORED PERMANENT INJUNCTION
STIPULATED AREAS

Philippine Sea Area



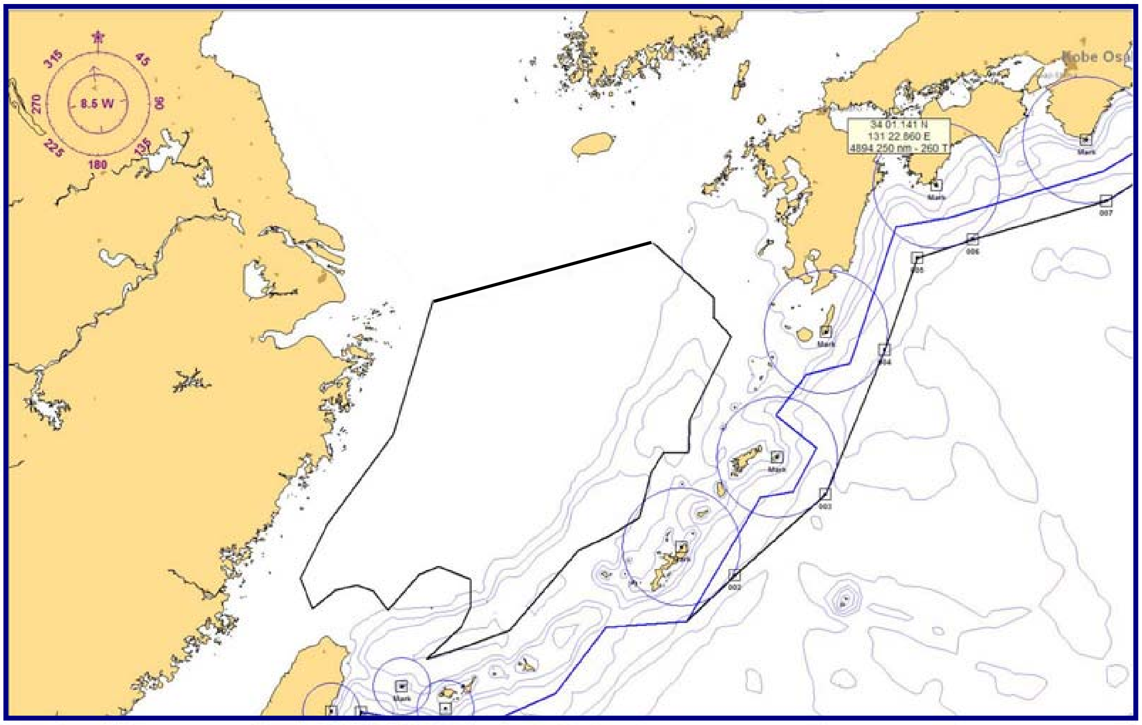
Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
Philippine Sea Year-Round					
1	10 00.0 N	127 09.5 E	19	31 34.6 N	132 38.6 E
2	10 00.0 N	137 16.0 E	20	30 05.1 N	132 02.4 E
3	11 00.0 N	137 37.0 E	21	27 41.6 N	130 54.9 E
4	11 00.0 N	140 44.6 E	22	25 33.5 N	128 19.4 E
5	10 00.0 N	141 31.9 E	23	25 26.9 N	126 48.3 E
6	10 00.0 N	155 00.0 E	24	24 19.4 N	125 50.8 E
7	40 00.0 N	155 00.0 E	25	23 26.6 N	123 42.3 E
8	40 00.0 N	143 32.7 E	26	23 53.4 N	122 53.3 E
9	35 09.6 N	141 55.4 E	27	24 01.3 N	122 15.8 E
10	34 17.2 N	140 55.2 E	28	23 02.2 N	121 56.4 E
11	33 06.7 N	140 58.4 E	29	21 29.7 N	122 13.8 E
12	31 02.2 N	141 17.3 E	30	21 22.6 N	122 39.9 E
13	28 24.4 N	142 52.1 E	31	20 55.4 N	123 04.8 E
14	27 01.8 N	140 47.1 E	32	17 03.5 N	123 35.4 E
15	30 10.7 N	139 10.3 E	33	15 33.5 N	123 01.2 E
16	32 45.7 N	138 35.4 E	34	14 41.2 N	125 07.0 E
17	33 34.3 N	138 14.5 E	35	12 31.1 N	126 28.9 E
18	32 29.3 N	136 12.3 E			
Philippine Sea Exclusion Zone Restricted					
1	28 49.9 N	141 53.9 E	20	12 40.5 N	144 35.8 E
2	28 24.0 N	142 52.8 E	21	12 52.2 N	144 14.9 E
3	27 39.4 N	143 15.9 E	22	13 19.9 N	144 01.1 E
4	26 33.3 N	143 16.6 E	23	13 57.6 N	144 15.4 E
5	25 51.3 N	142 57.4 E	24	14 45.4 N	145 01.0 E
6	24 54.2 N	142 22.7 E	25	15 00.0 N	144 37.4 E
7	24 22.9 N	142 26 2 E	26	16 44.9 N	144 46.6 E
8	23 57.5 N	142 24.2 E	27	19 17.6 N	144 31.1 E
9	21 26.0 N	144 44.6 E	28	20 15.0 N	144 00.7 E
10	21 24.5 N	145 13.5 E	29	20 32.5 N	143 56.1 E
11	21 01.1 N	145 43.5 E	30	20 50.2 N	143 59.3 E
12	19 55.5 N	146 21.7 E	31	23 20.0 N	141 41.6 E
13	18 14.8 N	146 46.6 E	32	23 19.3 N	141 18.8 E
14	17 33.4 N	146 49.8 E	33	23 31.0 N	140 50.2 E
15	16 30.0 N	146 42.4 E	34	23 55.9 N	140 31.0 E
16	15 00.0 N	146 43.0 E	35	24 51.7 N	140 15.3 E
17	14 51.2 N	146 13.5 E	36	25 39.0 N	140 18.3 E
18	13 47.4 N	145 44.3 E	37	27 10.0 N	140 44.8 E
19	12 50.1 N	145 04.4 E	38	28 50.0 N	141 53.9 E

Sea of Japan Area



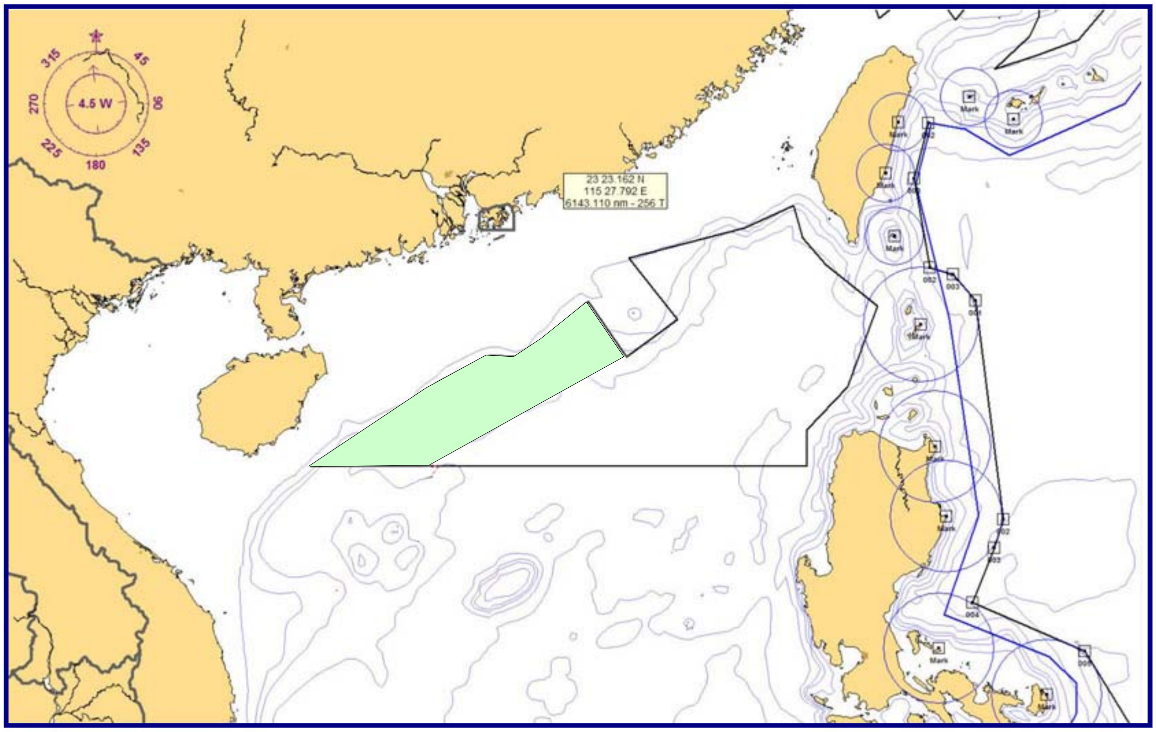
Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
Sea of Japan Restricted May thru July			Yamato Rise Restricted		
1	42 00.0 N	131 14.9 E	1	40 05.9 N	135 31.3 E
2	40 28.7 N	139 10.7 E	2	39 34.0 N	136 12.0 E
3	39 58.3 N	138 57.5 E	3	39 06.0 N	135 45.4 E
4	39 18.1 N	139 13.9 E	4	39 01.9 N	135 32.9 E
5	39 13.4 N	138 27.5 E	5	39 02.4 N	135 11.6 E
6	38 43.6 N	138 03.1 E	6	38 41.8 N	134 15.0 E
7	37 33.6 N	135 51.5 E	7	39 01.9 N	133 42.9 E
8	36 53.0 N	135 57.6 E			
9	36 18.2 N	135 19.2 E			
10	36 48.9 N	133 27.8 E			
11	37 24.1 N	132 13.0 E			
12	38 07.6 N	130 57.8 E			
13	37 45.7 N	129 43.1 E			
14	39 31.2 N	128 33.2 E			
15	40 25.3 N	130 12.2 E			
16	40 51.4 N	130 28.4 E			
17	41 24.1 N	130 28.9 E			

East China Sea Area



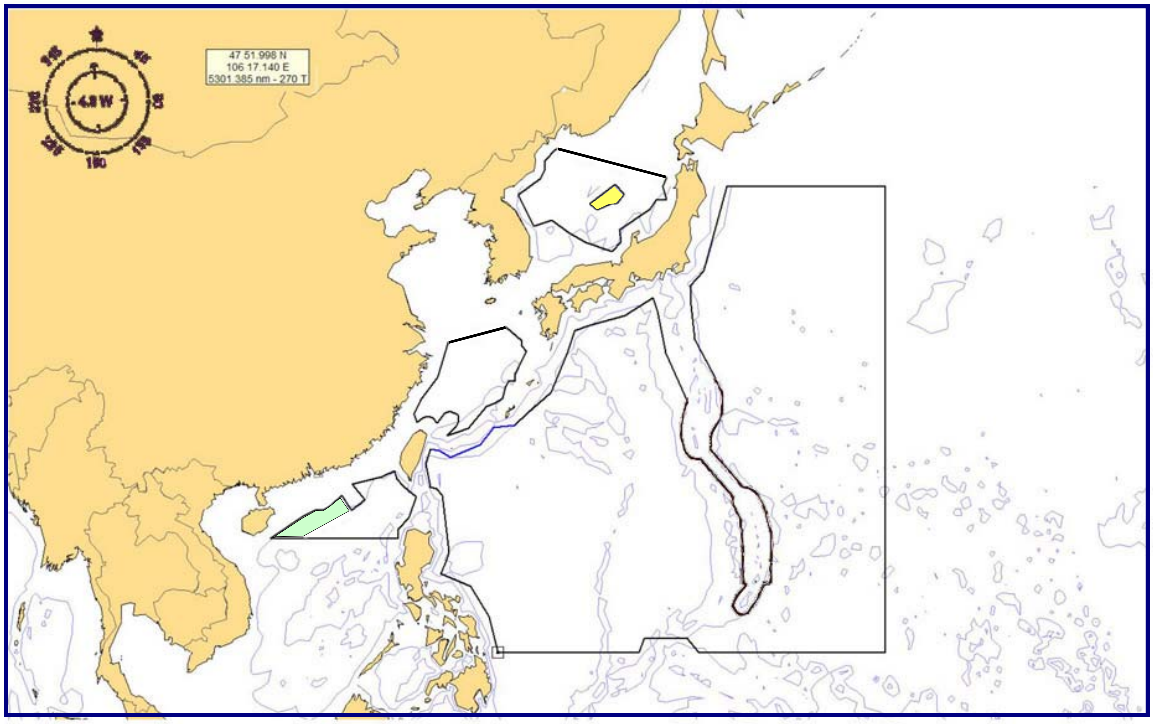
Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
East China Sea Year-Round					
1	31 49.2 N	127 40.3 E	15	25 27.9 N	124 05.0 E
2	30 55.6 N	128 50.1 E	16	25 48.9 N	124 15.8 E
3	30 36.6 N	128 49.5 E	17	26 16.2 N	124 14.7 E
4	30 18.0 N	129 09.4 E	18	26 29.1 N	123 39.5 E
5	28 56.1 N	128 22.3 E	19	26 20.4 N	123 17.6 E
6	28 23.6 N	128 20.8 E	20	25 44.5 N	122 42.6 E
7	28 23.2 N	127 52.5 E	21	26 03.9 N	122 25.3 E
8	28 03.7 N	127 38.8 E	22	26 10.2 N	122 06.9 E
9	27 18.5 N	127 25.9 E	23	26 04.6 N	121 42.8 E
10	27 00.5 N	126 53.1 E	24	25 46.3 N	121 17.3 E
11	26 45.7 N	126 17.0 E	25	26 16.9 N	121 03.3 E
12	25 24.0 N	124 59.3 E	26	27 11.8 N	121 33.8 E
13	25 08.7 N	124 14.0 E	27	28 41.6 N	122 47.9 E
14	24 54.1 N	123 25.7 E	28	30 54.3 N	123 33.5 E

South China Sea Area



Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
South China Sea Year-Round			South China Sea Restricted Nov thru Apr		
1	18 00.0 N	119 56.4 E	2A	18 00.0 N	112 58.9 E
2A	18 00.0 N	112 58.9 E	2	18 00.0 N	110 43.5 E
8	19 55.9 N	116 35.5 E	3	19 30.2 N	113 06.3 E
9	20 35.8 N	117 32.2 E	4	19 58.1 N	114 03.7 E
10	21 40.2 N	116 38 4 E	5	19 56.0 N	114 32.1 E
11	22 10.8 N	118 46.4 E	6	20 14.3 N	115 02.9 E
12	22 34.1 N	119 41.6 E	7	20 54.1 N	115 53.2 E
13	22 23.4 N	119 44.7 E	8	19 55.9 N	116 35.5 E
14	22 00.9 N	119 51.6 E			
15	21 32.9 N	120 17.7 E			
16	20 49.5 N	121 15.1 E			
17	19 24.2 N	120 42.2 E			
18	18 39.4 N	119 57.2 E			

All Areas



APPENDIX B

BACKGROUND FOR MARINE MAMMAL DENSITY AND STOCK ESTIMATES FOR SURTASS LFA THIRD ANNUAL REPORT

Background for Marine Mammal Density and Stock Estimates for SURTASS LFA
Third Annual Report

Stipulation Area #1   East of Japan/Spring

Specific Species Information:

blue whale: Stafford et al. (2001) studied the geographic variation of blue whale calls in the North Pacific. While there was no hydrophone coverage in the mid-latitudes off Japan, there was some coverage near the Kamchatka peninsula and along the western Aleutian Islands chain. All calls recorded on these hydrophones were northwest Pacific blue whale calls. Based on these data, it was decided that the best available data on blue whales are from sighting surveys associated with Japanese whaling (Tillman 1977). Limited data have been reported on blue whales since this species was the initial focus of whaling effort; therefore, data on fin whales are most appropriate to apply to blue whales. These data are comparable to density estimates in offshore areas of the eastern tropical Pacific (ETP) (Ferguson and Barlow 2001, 2003).

fin whale: Fin whales have been reported migrating south in the winter to about 20°N, and are found in the summer from a line near Japan north to the Chukchi Sea and Aleutian Islands (Evans 1987). Density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki 1977, Ohsumi 1977, Tillman 1977). These data are comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow 2001, 2003).

sei whale: Ohsumi (1977) derived abundance estimates of sei/Bryde's whale in the North Pacific in 10° longitude by 5° latitude bins based on catch statistics. Masaki (1977) summarized whale sighting data obtained from scouting boats belonging to Japanese whaling expeditions. These data provide encounter rates and effective search widths from which a density estimate was derived. An abundance estimate was calculated from the same data (Masaki 1977).

Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde’s whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. Density estimates are derived from scouting vessels sighting data (Ohsumi 1977). The International Whaling Commission (IWC) website is a source of stock estimate for the western North Pacific stock (22,000). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde’s whales at about 20°N, which is the southern limit of their summer range.

minke whale: The south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi 1978). Minke whales are migratory from the offshore western North Pacific waters. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). The IWC website is a source of stock estimate for the western North Pacific/Sea of Okhotsk stock (25,000). Ferguson and Barlow (2001, 2003) computed density estimates in offshore areas of the eastern tropical Pacific an order of a magnitude lower.

North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al. 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al. 2001) where animals are typically found May through September (Clapham et al. 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al. 2001). Clapham et al. (2004) note the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-December) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al. 2001, Clapham et al. 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al. 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring and fall in the areas east of Japan.

sperm whale: Three stocks are recognized in U.S. EEZ waters: a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate the best abundance estimate for the western North Pacific population is 102,112 (CV=0.155) (Angliss and Lodge 2002). Sightings by Kasuya and Miyashita (1988) suggest that in the summer, the density of sperm whales is high south of the Kuroshio Current System (south of approximately 35°N), but extremely low north of 35°N. Their data suggest that there are two stocks of sperm whales in the western North Pacific: a northwestern stock with females that summer off the Kuril Islands and winter off Hokkaido and Sanriku, and the southwestern North Pacific stock with females that summer in the Kuroshio Current System and winter around the Bonin Islands. The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea and in the Kuril Islands/Sanriku/ Hokkaido, respectively, during the summer. Therefore, this site (35°N) in spring will have southwest males moving through the region. As such, the density estimate is considered comparable to the Mobley et al. (2000) estimate (0.0010/km^2) where sperm whales were generally seen in the outer 5% of the survey effort. This is also comparable to the density estimate (0.0029/km^2) calculated from the summer/fall survey off Hawaii in 2002 (Barlow 2003).

Kogia: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution, and not believed to be concentrated anywhere. Summing the abundances of *Kogia breviceps, Kogia simus, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals is computed in the eastern tropical Pacific. At this northern latitude, only expect *Kogia breviceps*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 30° N (Ferguson and Barlow 2003), a density estimate of 0.0031 animals/km^2 was modeled.

Baird's beaked whale: Kasuya (1986) reported the presence of Baird's beaked whales off the east coast of Japan, as did Leatherwood and Reeves (1983). Miyazaki et al. (1987) did not report any Baird’s beaked whale strandings along the Pacific coast of Japan. Ohizumi et al. (2003) examined the stomach content of Baird’s whales caught off the east coast of Japan, and reported that the observed prey species were demersal fish that were identical to those caught in bottom-trawl nets at depths greater than 1000 m (3281 ft). Kasuya (1986) collected aerial survey sighting records over 25 years and shipboard sightings in 1984 off the Pacific coast of Japan. Individuals are just beginning to enter the region in the early summer, with a peak in August. Based on his encounter rate and effective search width, a spring density estimate of 0.0002/km^2 was derived. Kasuya’s (1986) abundance estimate of 4220 (CV=0.295) covered the region from about 32-40°N and seaward of the Pacific Japanese coast out to about 150°E. Since his surveys did not include habitat further north, the stock estimate is increased to 8,000 to account for unsurveyed areas.

Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best data available are the long-term time series from the eastern tropical Pacific (Ferguson and Barlow 2003): density estimate (0.0054/km^2) and abundance estimate of 90,725 animals.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported 5 strandings of *M. ginkgodens* from the east coast of Japan. Of the 15 known strandings of *M. ginkgodens*, Palacios (1996) reported 8 off Taiwan and Japan. Since no data on density or stock estimates are available for this species, it is roughly estimated that the data on *Mesoplodon* spp. from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate. Using the northernmost strata, the density estimate is 0.0005/km^2 and the abundance estimate is 22,799 animals.

Hubbs’ beaked whale: Miyazaki et al. (1987) reported five strandings of Hubbs’ beaked whales along the Pacific coast of northern Honshu. As a cold temperate species, Leatherwood and Reeves (1983) suggested that its southern limit in the western North Pacific is the warm Kuroshio Current, while its northern limit might be the cold Oyashio Current. Since no data on density or stock estimates are available for this species, it is roughly estimated that the data on *Mesoplodon* spp. from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate. Using the northernmost strata, the density estimate is 0.0005/km^2 and the abundance estimate is 22,799 animals.

false killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021/km^2) and an abundance estimate (30,214) were used from the eastern Pacific (Ferguson and Barlow 2003).

short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes using August and September data, from which an average density estimate was derived for the modeled site. Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35° N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43° N). Miyashita (1993) questioned whether the entire range consisted of a single stock or population, but had no way of delineating the data. However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya 1993), and it therefore was not included in the above analyses (Miyashita 1993).

Risso's dolphin: Miyashita (1993) reports a western North Pacific stock estimate (83,289 (CV=0.179)) and density estimate derived for the Pacific coast of Japan.

common dolphin: There are no data on density or stock estimates in the western Pacific (Miyashita 1993). Common dolphins are a gregarious species, and it is not unusual to find them associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and are found in waters of temperature 10 to 28° C (50 to 82.4° F). This species is very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate.

bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 (CV=0.261)) and density estimate off the Pacific coast of Japan ($0.0171/km^2$).

spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan. This species is not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993), and no data on density or stock estimates are available (Miyashita 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate.

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate (438,064 (CV=0.174)) and density estimate east of Japan ($0.0259/km^2$).

striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for two populations in the area: one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 (CV=0.186), and a density estimate for the Pacific coast of Japan was used for this site ($0.0111/km^2$).

rough-toothed dolphin: Species distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales. These animals are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. There are no data on stock or density estimates for the western North Pacific; therefore, density (0.0059/km^2) and abundance (145,729) estimates from the eastern Pacific waters were used (Ferguson and Barlow 2001, 2003)**.**

Fraser's dolphin: A highly gregarious species, groups of a hundred to a thousand have been observed. Fraser's dolphins are occasionally found mixed in herds of spotted dolphins, and observed in company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish encompassing both tropical and pelagic species (Leatherwood and Reeves 1983). Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Comparing feeding ecology of spinner and Fraser's dolphins, spinners feed primarily in upper 200 m (656 ft) but maybe as deep as 400 m (1312 ft), whereas Fraser's are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate.

Pacific white-sided dolphin: No data on density or stock estimates are available (Miyashita 1993). A gregarious species, pelagic in nature, these offshore creatures are encountered along or seaward of the 183-m (100-fm) contour. Pacific white-sided dolphins feed at night on the deep-scattering layer and have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). Density (0.0082/km^2) and abundance (67,769) estimates from eastern Pacific waters were used (Ferguson and Barlow 2001, 2003)**.**

Stipulation Area #2 North Philippine Sea/Spring & Summer

Specific Species Information:

Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. Density estimates were derived from scouting vessels sighting data (Ohsumi, 1977). The IWC website is source of stock estimate for the western North Pacific stock (22,000). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2003) observed Bryde's whales around Hawaiian Islands, deriving comparable density estimates.

minke whale: The south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi 1978). Animals are migratory from the offshore western North Pacific waters. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). The IWC website is source of stock estimate for the western North Pacific/Sea of Okhotsk stock (25,000). Ferguson and Barlow (2001, 2003) computed density estimates in offshore areas of the eastern tropical Pacific an order of a magnitude lower.

North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al. 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al. 2001) where animals are typically found May through September (Clapham et al. 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al. 2001). Clapham et al. (2004) note the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-December) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al. 2001; Clapham et al. 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al. 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring, fall and winter in the North Philippine Sea.

sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate the best abundance estimate for the western North Pacific is 102,112 (CV=0.155) (Angliss and Lodge 2002). Sightings collected by Kasuya and Miyashita and Kasuya (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands and winter off Hokkaido and Sanriku, and the southwestern North Pacific stock with females that summer in the Kuroshio Current System and winter around the Bonin Islands. The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea and in the Kuril Islands/Sanriku/Hokkaido, respectively, during the summer. Therefore, this site (29° N) in spring and summer is located in between the concentrations of southwest females and southwest males. As such, the density estimate is considered comparable to Mobley's estimate (0.0010/km^2) where sperm whales were generally seen in the outer 5% of survey effort (Mobley et al. 2000) and 0.0029/km^2 from Barlow (2003).

Kogia: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution, not believed to be concentrated anywhere. Summing the abundances of *Kogia breviceps, Kogia simus, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals was computed in the eastern tropical Pacific. At this northern latitude, only expect *Kogia breviceps*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 30° N (Ferguson and Barlow 2003), a density estimate of 0.0031/km^2 and an abundance estimate of 166,553 was modeled.

Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate ($0.0054/km^2$) and an abundance estimate of 90,725 animals from the eastern Pacific (Ferguson and Barlow 2003).

Blainville's beaked whale: Miyazaki et al. (1987) reported 2 strandings on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate. The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported 5 strandings of *M. ginkgodens* from the east coast of Japan and 2 strandings from the east coast of Taiwan. Of the 15 known strandings of *M. ginkgodens*, Palacios (1996) reported 8 off Taiwan and Japan. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data on *Mesoplodon* spp. from the eastern Pacific (Ferguson and Barlow 2001; 2003) are appropriate.

killer whale: A few schools have been seen off the southeast coast of Honshu (off Taiji) in April, October, and November; however, none have been taken in the drive fisheries (Miyashita 1993). Without any data for the western North Pacific, best available data are from the long-term time series is the eastern tropical Pacific (Ferguson and Barlow 2001, 2003); density estimate ($0.0004/km^2$) and abundance estimate (12,256).

false killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate ($0.0021/km^2$) and abundance estimate (30,214) from eastern Pacific (Ferguson and Barlow 2003) were used.

melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. Abundance estimated from eastern Pacific (36,770 animals) (Ferguson and Barlow 2001, 2003). A density estimate from similar latitudes in the eastern Pacific (Ferguson and Barlow 2001, 2003) was used ($0.0012/km^2$). This value is very similar to the estimate from Mobley et al. (2000): $0.0021/km^2$.

short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

Risso's dolphin: Miyashita (1993) reported an abundance estimate (83,289 (CV=0.179)) and density estimate off southern Japan/east Taiwan (0.0106/km^2).

common dolphin: There are no data on density or abundance estimates for this species in the western Pacific (Miyashita 1993). Common dolphins are gregarious, and it is not unusual to find them associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and found in waters of temperature 10 to 28° C (50 to 82.4º F). These animals are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern Pacific (Ferguson and Barlow 2001, 2003) at the same latitudes are appropriate.

bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 (CV=0.261)) and density estimate off southern Japan (0.0146/km^2).

spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan, and this species was not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993). No data on density or abundance estimates are available (Miyashita 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. Miyashita (1993) abundance estimate (438,064 (CV=0.174)) and density estimate off southern Japan/east Taiwan (0.0137/km^2) were used.

striped dolphin: There are two concentrations in western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is also the potential for three populations in the area: one south of 30°N, one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 (CV=0.186)). The density estimate off southern Japan/east Taiwan (0.0329/km^2) was used.

rough-toothed dolphin: This species has a primarily pelagic distribution in tropical to warm temperate waters. They are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. There are no data on abundance or density estimates for the western North Pacific; therefore, a density estimate (0.0059/km^2) from eastern Pacific waters was used (Ferguson and Barlow 2001, 2003).

Fraser's dolphin: Being a highly gregarious species, groups of a hundred to a thousand Fraser's dolphins have been observed. They are occasionally found mixed in herds of spotted dolphins and observed in company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves

1983). Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Comparing the feeding ecology of spinner and Fraser's dolphins, spinners feed primarily in upper 200 m (656 ft) but maybe as deep as 400 m (1312 ft), whereas Fraser's are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Without any data on abundance or density estimates for the western North Pacific, it is roughly estimated that data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

Pacific white-sided dolphin: No data on density or abundance estimates are available in the western North Pacific (Miyashita 1993). A gregarious species, these pelagic, offshore creatures are encountered along or seaward of the 183-m (100-fm) contour. They feed at night on the deep-scattering layer and have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). Density estimate from same latitudes in eastern Pacific waters was used (Ferguson and Barlow 2001, 2003)**.**

Stipulation Area #3 West Philippine Sea/Winter, Spring & Summer

Specific Species Information:

fin whale: Fin whales winter to about 20°N, including waters along the Pacific coast of Japan. Since fin whales migrate south from offshore waters of the northwest Pacific, density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki 1977; Ohsumi 1977; Tillman 1977). These data are comparable to density estimates in offshore areas of the eastern tropical Pacific (Ferguson and Barlow 2001, 2003).

Bryde's whale: Animals found around the Bonin Islands are an offshore morph of *Balaenoptera edeni*. 3 stocks are currently recognized in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific (Yoshida and Kato 1999). The Ohsumi (1977) density estimate was used. The IWC website is source of stock estimate for the western North Pacific stock (22,000). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2003) observed Bryde's whales around the Hawaiian Islands, deriving a comparable density estimate.

minke whale: The south coast of Honshu and Shikoku were whaling grounds for the minke whale (Ohsumi 1978). Animals are migratory from the offshore western North Pacific waters. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). The IWC website is source of stock estimate for western North Pacific/Sea of Okhotsk stock (25,000). Ferguson and Barlow (2001, 2003) computed density estimates in offshore areas of the eastern tropical Pacific an order of a magnitude lower.

humpback whale: Humpback whales are only expected in this region during the winter, and they are typically found in water depths of less than 183 m (100 fm). Humpback wintering grounds in the western North Pacific are the Ryukyu Islands, Formosa and Bonin Islands (Evans 1987). Three populations of humpbacks are recognized in U.S. EEZ waters, the third being the (quoted from Angliss and Lodge 2002): “winter/spring population of Japan which, based on Discovery Tag information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966; Nishiwaki 1966; Darling 1991) - referred to as the Western North Pacific stock. Some recent exchange between winter/spring areas has been documented (Darling and McSweeney 1985; Baker et al. 1986; Darling and Cerchio 1993), as well as movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Darling et al. 1996; Calambokidis et al. 1997).” The best abundance estimate for the western North Pacific stock is 394 (CV=0.084) (Angliss and Lodge 2002).

sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, a central North Pacific stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Angliss and Lodge 2002). Preliminary data indicate best abundance estimate for the western North Pacific is 102,112 (CV=0.155) (Angliss and Lodge 2002). Sightings collected by Kasuya and Miyashita (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands and winter off Hokkaido and Sanriku, and the southwestern North Pacific stock with females that summer in the Kuroshio Current System and winter around the Bonin Islands. The males of these two stocks are found north of the range of the corresponding females, i.e., in the Kuril Islands/Sanriku/Hokkaido and in the Kuroshio Current System, respectively, during the winter and in the Bering Sea and in the Kuril Islands/Sanriku/Hokkaido, respectively, during the summer. As such, the density estimate is considered comparable to Mobley’s estimate (0.0010/km^2) where sperm whales were generally seen in the outer 5% of survey effort (Mobley et al. 2000) and to the Barlow (2003) estimate of 0.0029/km^2.

Kogia: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution that are not believed to be concentrated anywhere specific. Summing the abundances of *Kogia breviceps, Kogia simus, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals was computed in the eastern tropical Pacific. At this latitude, expect *Kogia breviceps* and *Kogia simus*. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow 2003), a density estimate of 0.0017/km^2 was modeled.

Cuvier's beaked whale: No data are available for Cuvier’s beaked whales in this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate (0.0003/km^2) and an abundance estimate of 90,725 animals from the same latitudes in the eastern Pacific (Ferguson and Barlow 2003).

Blainville's beaked whale: Miyazaki et al. (1987) reported 2 strandings on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001; 2003) are appropriate. The *Mesoplodon densirostris* abundance estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032.

ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported 2 strandings of *M. ginkgodens* from the east coast of Taiwan. Of the 15 known strandings of *M. ginkgodens,* Palacios (1996) reported 8 off Taiwan and Japan. Leatherwood and Reeves (1983) stated that some hunting of this species apparently takes place in Taiwan. Since no data on density or stock estimates are available for this species, it was roughly estimated that the density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the eastern Pacific (Ferguson and Barlow 2001, 2003) are approximate.

false killer whale: Miyashita (1993) estimated the abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 (CV=0.263)). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site.

pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021/km^2) and abundance estimate (30,214) from eastern Pacific (Ferguson and Barlow 2003) was used.

melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. Density and abundance estimates from the eastern Pacific (Ferguson and Barlow 2003) were used.

short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 (CV=0.224)). He also derived density estimates in 1° latitude by 1° longitude boxes. There was limited coverage of the Philippine Sea, but Kishiro and Kasuya (1993) reported a southern limit to the short-finned pilot whale range of approximately 20°N; therefore, a density estimate was derived as one-half the density estimate of the area south of Japan. Kasuya and Miyashita (1988) suggest that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya 1993), and it was therefore not included in the above analyses (Miyashita 1993).

Risso's dolphin: Miyashita (1993) abundance estimate (83,289 (CV=0.179)) and density estimate off southern Japan/east Taiwan (0.0106/km^2) were used.

common dolphin: There are no data on density or stock estimates for this gregarious species (Miyashita 1993). It is not unusual to find common dolphins associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. These pelagic, offshore creatures are encountered along or seaward of the 100-fm contour and are found in waters of temperature 10 to 28° C (50 to 82.4° F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

bottlenose dolphin: Miyashita (1993) abundance estimate (168,791 (CV=0.261)) and density estimate off southern Japan (0.0146/km^2) were used.

spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait, but none were reported from the Philippine Sea. Spinners are also not mentioned in historical Japanese whaling records (Kishiro and Kasuya 1993), and no data on density or abundance estimates are available (Miyashita 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. The Miyashita (1993) abundance estimate (438,064 (CV=0.174)) and density estimate off southern Japan/east Taiwan (0.0137/km^2) were used.

striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. However, there is the potential for only one population in the area: one south of 30°N, though the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 (CV=0.186)). One-half the density estimate from off southern Japan/east Taiwan for this site (0.0164/km^2) was used.

rough-toothed dolphin: Their distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied eastern tropical Pacific. No data on stock or density estimates for the western North Pacific are available; therefore, a density estimate (0.0059/km^2) and an abundance estimate from the ETP (145,729) were used (Ferguson and Barlow 2001, 2003)**.**

Fraser's dolphin: Kishiro and Kasuya (1993) reported takes of Fraser’s dolphin off the Pacific coast of Japan in the Japanese drive fisheries. Dolar et al. (2003) reported Fraser’s and spinners found together in the eastern Sulu Sea, Philippines. Amano et al. (1996) also stated that Fraser’s dolphins are common in Philippine waters. A highly gregarious species, groups of a hundred to a thousand have been observed, are occasionally found mixed in herds of spotted dolphins, and observed in the company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves 1983). A comparison of the feeding ecology of spinner and Fraser’s dolphins indicates that spinners feed primarily in upper 200 m (656 ft), but maybe as deep as 400 m (1312 ft), whereas Fraser’s dolphins are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

Pacific white-sided dolphin: There are no data on density or stock estimates available for this species (Miyashita 1993). These pelagic, offshore animals are encountered along or seaward of the 100-fm contour, and feed at night on the deep-scattering layer. Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves 1983). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the eastern tropical Pacific (Ferguson and Barlow 2001, 2003) are appropriate.

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